

THE INTEGRATED SCHEDULING SYSTEM:

A Case Study in Project Management

Preface

This research was conducted under the auspices of the Research Institute for Computing and Information Systems by Peter C. Bishop, director of the Space Business Research Center at the University of Houston-Clear Lake. Software evaluations were conducted by the Huntwick Consulting Group under the supervision of Everette Gardner and Dennis Adams from the Department of Decision and Information Sciences at the University of Houston. Thanks go to David Learned and Cissy Yoes, students from the University of Houston-Clear Lake, for their efforts in coordinating the research activity.

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**The Integrated Scheduling System:
A Case Study in Project Management**

by

Peter C. Bishop, Ph.D.
David B. Learned, B.A.
Cissy A. Yoes, M.S.

Space Business Research Center
University of Houston-Clear Lake

prepared for

Management Integration Office
Space Station Freedom Project Office
NASA Johnson Space Center

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Executive Summary

This study was designed to develop a prototype project management system for the Level III Project Office for the Space Station Freedom at the NASA Johnson Space Center. Conducted by The Space Business Research Center of the University of Houston-Clear Lake, the goal of the study was to establish a framework for the Space Station Project Office whereby Project and Office Managers can jointly establish and review scheduled milestones and activities. The objective was to assist office managers in communicating their objectives, milestones, schedules and other project information more effectively and efficiently.

The approach of the project was to convene a working group of representatives from each office to help develop and review iterative designs of a baseline system for accomplishing the study objectives. The study team interviewed project office and office-level managers on their need for such a system and their preference for how it would operate.

The system, proposed by the study team, was to produce weekly Gantt charts describing each office's tasks and major milestones over a 12 month period. The system would run on a stand-alone PC using traditional project management software. A representative from each office would submit their information to a

system operator who would produce and distribute the hardcopy charts for the weekly mangement meeting.

A system for scheduling meetings and conference rooms, and a system for tracking actions were also included in the original prototype design. Neither of these systems was included in the initial implementation. A meeting system, using word processing software and a central operator was already in place. An action tracking system, which was more detailed then logging the incoming and completed actions, was not essential at this time.

Consideration of sophisticated project management systems was included in this study, but each of the systems reviewed had limitations in meeting the stated objectives. The more sophisticated project management systems were not justified at this time. A communication system, supported by a simple computer system, was proposed as the appropriate system. The prototype system was adopted immediately and has been running in the Office for more than six months.



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Background

The Space Station Freedom was approved by President Reagan in 1984 and initially funded in FY85. It is by far the largest space project ever undertaken by any nation in history.

The NASA organization for building, launching, assembling, and operating the space station is evolving. Since the funding has not occurred as fast as many hoped, however, the organization has developed slowly. As it now stands, the space station organization consists of a Level I office at NASA Headquarters, a Level II program office in Reston VA, and Level III project offices at each of the major NASA centers.

This study was conducted at the Level III project office at the Johnson Space Center. This office is in charge of planning, supervising and coordinating contractor work on Work Package #2. The work consists almost exclusively of project management as opposed to actual design and development (which is conducted by the contractor). One of the elements of successful project management is that all the participants know the overall plans for the project and their role in accomplishing those plans. All participants should also understand how much progress the program has made toward each of its objectives and what must be accomplished in order to reach the remaining objectives.

At the beginning of a program such as the Space Station Freedom, objectives are unclear. They are communicated among a relatively small group of people on a face-to-face, ad hoc basis. As the program matures, however, a more formal mechanism is required so that a larger number of participants can effectively and efficiently share a set of objectives, milestones and progress reports among themselves. Without such a mechanism, program managers are generally in the dark about "what is going on," "where are we", and "what is most important at this time" in the plan. Without proper information, they cannot effectively plan and direct their own organizations to maximum achievement on high priority items nor coordinate their work with related projects.

Study Objective

In the summer of 1988, the JSC project office recognized the need for a more formal mechanism for communicating and coordinating goals and objectives within the management group. They initiated a study to develop a prototype of such a mechanism called the Integrated Schedule Plan. The purpose of the Plan was to provide "the project managers with top-level integrated schedule information." The approach was straightforward: Develop a standard scheduling format and monitor those schedules for management purposes.

The Space Business Research Center (SBRC) at the University of Houston-Clear Lake undertook the study on behalf of the Management Integration Office at JSC Level III. The SBRC submitted a proposal for this study in which the objective was to:

Develop a prototype project management framework for the Space Station Project office whereby Project and Office Managers can jointly establish and review scheduled milestones and activities.

Study Approach

The core of the approach to the study was an iterative development process in which key elements of the system are simultaneously planned in successive stages until the final solution is achieved. The elements chosen for development were the system requirements, products, configuration, and data. The complete development approach as proposed is contained in Appendix I. The proposal also contained the initial (strawman) specification of these four elements as a basis for discussion and refinement.

Another important aspect of the approach was to involve many of the people who were to use the system in its planning and development.

One means of involvement was a working group consisting of representatives from all of the project's major offices. The working group acted as the primary contact between the project team (the NASA technical monitor and the research staff) and the project office itself. The working group met frequently to discuss the four key elements of the design and review recommendations on those elements. (A complete chronology of major events is included in Appendix II.)

Another method of involving participants was to interview the principal managers in the project office on their perception of the need for an integrated scheduling system and their recommended approach to such a system. The interview topics included:

- 1) The scheduling products
- 2) How schedules are created and manipulated by each individual
- 3) Quantitative measures: (number of offices, people etc.)
- 4) How schedules are coordinated and communicated among individuals
- 5) What should stay the same and what should be changed

Interview sessions included the respondent, two or three representatives from the University of Houston and the NASA technical monitor for the study. The

format was open, and the discussion ranged across a number of topics related to project management.

A final aspect of the approach was to recommend a computer hardware and software configuration that would support the scheduling process finally adopted. For that purpose, the SBRC asked the UH Department of Decision and Information Sciences to support the task and provide a recommendation in that area. Faculty from that Department were to obtain examples of leading project management and scheduling software and rate them on their utility for this task.

The overall approach consisted of a research team composed of SBRC and UH personnel, a working group consisting of representatives from each of the offices involved, and interview respondents drawn from the key managers in the project office. This group worked through two iterations of the system specification before the project concluded.

Results

The Need for Communication

The study was formally initiated at the first working group meeting at which the group participants were briefed on the nature of the task and the approach recommended by the technical monitor and the contract team. At that same meeting, one of the managers in the Project Office made a strong statement about his need for the Integrated Scheduling System. He stated very simply that it was extremely difficult to do his job because he was unclear about exactly the plans which the separate offices were pursuing and the order or priority of those plans. He was specifically concerned that he would not know in time that the Office could not support a major milestone (a major review or deliverable) because of problems occurring within the individual offices. He stated that the scheduling system as outlined would give him a better grasp of the tasks being addressed by the offices as well as sufficient warning when those tasks were in trouble.

The working group perceived needs of their own. First, they accepted the management's need for better understanding of office level activity. On the other hand, they also indicated a need for overall project level direction and coordination of objectives and schedules. They saw the objectives and schedules for the project on the whole as chaotic and unplanned. Most believed that the confusion resulted from the variable and unpredictable actions coming to the office from other NASA

offices. For whatever reason, planning office-level activity in such an environment was considered almost impossible. These perceptions were later confirmed in interviews with the office managers.

Both of these perceptions caused the project team to emphasize one aspect of the task over all others. The initial requirement involved four scheduling tasks: create, manipulate, coordinate (between offices) and communicate schedules and related information. The issue from the management and from the office level perspective, however, involved communication of existing objectives and activities much more than the other scheduling activities. Hence the research team oriented its work primarily to providing a system whereby management could identify its priorities to the individual offices and the offices could provide management with a periodic assessment on their activity to address that priority.

Results

The Objects to be Communicated

Interviews among office managers revealed three types of information they needed in order to do their jobs. First they wanted milestone information, particularly when certain deliverables were due. The scheduling system as it was originally conceived had already discovered and addressed that need.

Interviews also revealed a similar problem in the meeting scheduling system. Managers expressed the opinion that the meeting schedule was out of control. While a weekly list of scheduled meetings was already being published, the meetings themselves were often overlapping, presenting conflicts for people who had to attend. They often had to be changed at the last minute--presenting an almost unmanageable situation for those required to attend. Finally, even scheduling rooms for meetings was an issue requiring numerous telephone calls and changes.

A third category of important information for the project offices was the set of actions which the office received from Level II and from the contractor. Actions from Level II usually consisted of ad hoc studies or decisions which Level II required in a limited time frame. Some actions were of such priority that they swept aside all other work. Others, however, got "lost in the system." Many managers felt anxious that they were "missing or forgetting something important." Actions from the contractor were often documents to be reviewed or RIDs to the

contract. These actions often required the Office to act in a specific period of time (e.g. 45 days) or else the document or RID was considered accepted. Managers were equally anxious that they were not tracking and acting on these actions in a timely manner.

Based on the results of the interviews, the research team recommended that the Office consider three types of information in the scheduling system: milestones, meetings, and actions. Tracking and communicating these items would go a long way to standardizing and coordinating the actions of the Project Office and the office level managers.

Results

The Communication Process

The ideal scheduling system in most managers' minds was an on-line system in which they or someone in their office could access milestones, meetings and actions at a moment's notice. They would likewise enter the information about their office directly into the system so that updates would be available to everyone else in real-time. The system, as imagined, would have been outstanding. Unfortunately, the ideal system is impossible in the current environment. Although such an integrated system could have been developed (at considerable expense), this path was rejected because it would entail lengthy development and on-going maintenance.

The major obstacle was the lack of a network between office workstations that would allow offices to share a common electronic system. No local area networks existed. Instead, work station computers are linked together through a central corporate mini-computer. Such configuration will not support the individual manipulation and office wide distribution of data.

Interoffice communication was currently being handled by NASAMAIL, an electronic message system. Plans were underway to implement the Digital Equipment's office automation package, All-in-One, on the corporate VAX, but All-in-One could not handle such a system nor did any alternate candidate appear.

Clearly, an on-line system, no matter how desirable, was not feasible at the present time.

A dynamic system where managers could manipulate and analyze the parameters of their activities and plans was originally perceived as desirable. However, the interviews revealed that managers rarely used the more technical aspects of project management (linking tasks, critical path modeling, and automatic resource allocation) in their daily routines. Systems which provided such functions are not user-friendly and would require a large training curve to be overcome.

An additional problem to the ideal integrated system was the diversity in how each of the offices handled its internal project affairs. The differences in management style, in knowledge and use of project management techniques and tools, and in level of automated support were considerable. An integrated system would have had to impose a standard structure on all project management activities throughout the project office--a daunting and perhaps impossible task. The real system, one that had some chance of success, had to accommodate the differences between offices. As a result, it needed to be simple, robust, able to handle a diversity of inputs and still accomplish its task--i.e., to track and communicate milestones, meetings, and actions among project and office-level management. Any highly integrated or technical system could not have accomplished that task without destroying the working arrangements already in place.

Results

The Process

The conclusions that emerged from the management interviews were the following:

1. Office-level managers needed to know what project priorities and milestones were. Project managers needed to know how well the offices were doing in supporting those priorities. The office needed a communication system more than it needed a scheduling system.
2. Managers needed such information, not only about milestones, but also about meetings and actions.
3. The environment was highly diverse and did not offer the computer connectivity for a standardized, on-line, integrated system. The system therefore had to be simple, straightforward, and robust.

The system as finally proposed is included in Appendix III. Briefly, it is a weekly publication of milestones, meetings and actions to all project and office-level managers. Individual office managers submit information about their office toward the end of the week. The information comes to one operator who enters the information into the system and generates a GANTT chart on the major activities for each office. The updates are published every Monday in time for the project staff meeting. Managers discuss changes to the information weekly so that all have a clear idea of where the project stands with respect to its major objectives and deliverables.

The major advantage to this system is that it will work in the present environment. While the process does lack the glamour of sophisticated technology and the innovation of a "new approach" to solve "new problems", it does address the current environment and needs as identified by the users. The problem was communication. The immediate need was to provide for the structured exchange of important information in a consistent and timely manner.

A second advantage is that the system is consistent with available resources, management style, and user's understanding. It does not require any additional resources. A new software product is being utilized by the central coordinating person, but is not essential to the operation of the system. No appreciable difference was required in management style. The proposed system provides for

structure and preliminary data collection to support a pre-existing weekly meeting among office managers. The users of the system were briefed in the procedural components of the system, but not required to learn new skills or to develop new procedures within each individual office. The proposed system was established immediately, and appreciable improvement in the vertical and horizontal exchange of information was apparent to management after only a few weeks.

There are, of course, some disadvantages to the proposed system. The system is highly susceptible to poor quality input. The quality of input is dependent on the understanding and motivations of each individual office representative for what information is important for others to have. Additionally, the system does not operate in real-time, a function that can only be accomplished by a highly networked and automated system. Another limitation is that managers cannot manipulate the data electronically once it is received. Manipulation of data was not found to be a strong requirement, however, but it could prove beneficial in future planning and management efforts. A final limitation is that the system is dependent on the operation of one central person and one workstation. This single point of support puts the system at risk unless adequate provisions are made for appropriate backup support in case of absenteeism or turnover. On balance, the proposed system does a credible job. Since it involved no irreversible decisions, it can also grow and change as the task and management style of the Project Office evolve

over time. Having invested in and being required to use a sophisticated, but permanently rigid system, may have been the greatest of all possible risks to the effective operation of the office in the future.

Results

The Tools

One part of the study was to find and evaluate electronic tools for supporting whatever system was proposed. The UH Department of Decision and Information Sciences was asked to conduct this study in parallel with the interviews and the development of the system itself. Their results are reported in Appendix IV.

Briefly, they found some tools which supported part of the system as proposed but no one tool that supported all of them. Originally, they felt that a highly general tool, such as Lotus Agenda might be suitable. The working group, however, felt that Agenda was not a mature product, that it would require extensive customization and development, and that it had to run on a local area network to operate at its best.

The research team was then prepared to propose three tools, one for each of the tasks--milestones, meetings, and actions. The milestone tool was the revised version of Timeline, a PC-based project management and scheduling system. It seemed easier to use than Super Project Expert, the JSC supported product, and it also was compatible with Artemis, the engineering management tool for the SSFPO. Timeline also provided more flexibility in the creation of its GANTT charts than did other project management software packages. That seemed to be

a important consideration for an organization like SSPO which uses GANTT charts to communicate various sorts of information.

A simple meeting scheduler entitled Who What When? was to have been recommended for central use to arrange meeting rooms and produce the weekly meeting calendar. Lotus Agenda was recommended for an action tracking system because of its depth and flexibility.

In the end, none of these recommendations were formally proposed. Before the recommendation presentation meeting took place, McDonnell Douglas demonstrated a project management tool, developed under contract by Advanced Management Solutions. The package seemed exceptionally capable and able to support the milestone tracking process as proposed. What is more, McDonnell Douglas had developed and was using it for its space station work so that compatibility with the NASA system was assured. The tool will contain an interface to Artemis in a future release. Finally, McDonnell Douglas offered the demonstration version to the Project Office for free. Based on these considerations, the Office decided to use the MDAC tool rather than seek a commercial product.

Milestone tracking was the priority item in this project. It was unlikely that the Office would need computer support for the meeting or action tracking processes. Hence no tools were recommended in those areas.

Results

Implementation

The research team submitted its final baseline in early December outlining the steps recommended for implementing and initializing the system. The team recommended a period of familiarization with the system before full operation should begin. The system operation was also based on a set of changes (delta's) from previous benchmarks. Those benchmark values for milestones, meetings and actions had to be prepared before full operation.

The Office began the actual implementation of the system. They acquired the MDAC system in the Spring of 1989 and asked the Correspondence Control Office to act as the system operator. The Correspondence Control Office already had experience publishing the weekly calendar so they were familiar with the procedure.

The Project Office, through the Management Integration Office, did implement almost all aspects of the recommended procedure, albeit in an abbreviated form. Little orientation and familiarization was offered before the system went into operation. The system initially tracked milestones by office but that procedure produced too much detail to be useful. The Project Office subsequently developed a list of ten Priority Activities and seven Selected Action

Items to track. Each activity and item was delegated to a specific office who was responsible for submitting data on that issue.

Offices responsible for a particular section "redline" previous publications to indicate changes in dates and submit new material in "bulk" form--reports, memoranda, etc. The workstation operator enters the redline material directly and interprets the bulk material for possible inclusion. Thus the input is still highly variable and requires some analysis to reduce it to the common format. T h e results are published on a weekly basis and discussed at management meetings as recommended. Participants seem satisfied that the system as implemented meets their need to know what is happening throughout the Project Office. Office-level managers reported that they find the information about other office-level activities valuable for their own planning and operation. Although the task was directed to consider only vertical communication within the office, this system has already improved horizontal communication as well.

Although the MDAC tool has a standard set of project management features (linking tasks, assigning resources, extrapolating schedules), the only feature currently being used is placing milestones markers on a three-month moving window. The markers are used to indicate upcoming events, meetings, and actions in the three-part system.

Discussion

This research activity began as a task to develop a sophisticated, on-line project scheduling tool to support information exchange within the SSFPO office. An investigation of the needs, resources and operations of the Office determined that a fully automated computer system was not feasible at that time. The final recommendation was to establish subtle, but significant changes in the process of communicating project objectives and schedules.

The outcome of this study has important implications for future tasks in using information technology to support human work. First, the study illustrates a fundamental pattern in human problem solving. As individuals imagine a solution to a specific problem, they usually overestimate the technological sophistication of the solution. This belief in the value of technological solutions is encouraged by the news media and the technology vendor. The news media emphasizes the "news"--that which is new, startling, revolutionary, promising, exciting. Their job is selling newspapers, magazines, broadcast time, advertising. Therefore, they concentrate on leading edge technology, the state of the art, if you will.

Real solutions, on the other hand, must be implemented with technology as it actually exists, the state of the practice. Few people know about the state of the practice because it is not "newsworthy." Furthermore, vendors are interested in selling a product while the actual implementation of that product is often left up

to the customer. It is a common failing, therefore, that the vendor might promise more from their product than it can actually deliver, certainly without extensive modification or training. Unfortunately, customers soon become cynical, believing that all technical solutions are hyped since they have been disappointed in the past.

Another reason for overestimating the effectiveness of information technology is that most organizations do not have the resources or the infrastructure to make use of the most modern tools. Systems currently filling the pages of PC magazines will usually require workstations with fast processors (80386), large memories (more than 640K), large disks (more than 20mb), and which are completely networked throughout the organization. Most systems in place, however, are stand-alone PC-XT's with small hard drives, if any at all. The difference between what we read and what we can use is enormous. Current human and technical systems simply cannot accommodate the most advanced technology without serious restructuring. Such changes will take place, eventually, but the utility of the most advanced technology in providing near-term solutions is often overrated.

The fundamental difficulty is that sometimes technology provides tools that are too sophisticated for the task at hand or for the people who will be using the tool. The gap between the potential and the reality is the difference between *what the tool can do* and *what the user wants to do and is capable of doing with it*. An automated system is only as reliable and valuable as the process which supports

the system. Managers who want to establish a computer-supported project management system must first understand and use the project management concepts and techniques which the tool requires. The creation and linking of tasks, assignment of resources and deadlines, and determining key evaluation criteria are human activities. Machines can assist people in making those decisions, but they will never replace them. Knowledge and mastery of project management skills is required before any automated system can track and respond to project management needs.

Traditional techniques of project management were difficult to adopt in the SSFPO because the task was inherently ambiguous and rapidly evolving. Project management techniques, as with any method or tool, are best in stable, well-understood tasks--such as building a bridge, planning an ad campaign, issuing a bond. In this case, people were involved in building a space station, a task never before attempted in human history. While textbook project management may be the ideal, the reality often requires at least as much coping as it does planning.

Summary

The proposed system was adopted and implemented in November 1988 and has been working satisfactorily for nine months. Users of the system are comfortable with the process and have noted measurable improvement in their communication of project tasks and objectives. The managers needed a framework in which to communicate their priorities, their activities, and their problems in an effective and efficient way, while at the same time obtaining pertinent and useable information from each individual office. The Integrated Scheduling System provides the framework for such a system.

Future enhancements of the project management system and its computer-support at all levels of the SSFPO office will surely take place as they are needed. At the moment, however, the immediate, critical needs of the SSFPO office are being met through the incorporation of a simple and appropriate solution, while also solidifying the foundation to support the extensions to present project management applications.

Future Directions

No project, particularly one as dynamic as the Space Station Freedom, ever stands still. The project management tasks will become more complex as the development for the space station proceeds. The management processes to support those tasks will likewise need to become more capable and efficient. As a result, the Space Station Freedom Project Office will most likely be seeking to upgrade the processes and the computer systems to support them. Two types of upgrades are likely as the next steps in the development of its project management.

One upgrade that would support more complex operations is the more technical side of project management. The current process communicates tasks and milestones among a small group of managers. But the process is static. It takes inputs from managers on paper and translates them into computer generated GANTT charts. The tasks themselves have no dynamic relation to each other nor are the resources identified to support the tasks. The hardcopy presentation does not allow managers to use the data in their own planning or in deciding how to adjust their inputs for the next iteration.

Current PC tools (including the MDAC tool) allow operators to manipulate these variables of task, schedule, and resource in order to create the optimum mix of components for their objective. SSFPO will soon be needing those tools to support a complex form of project management.

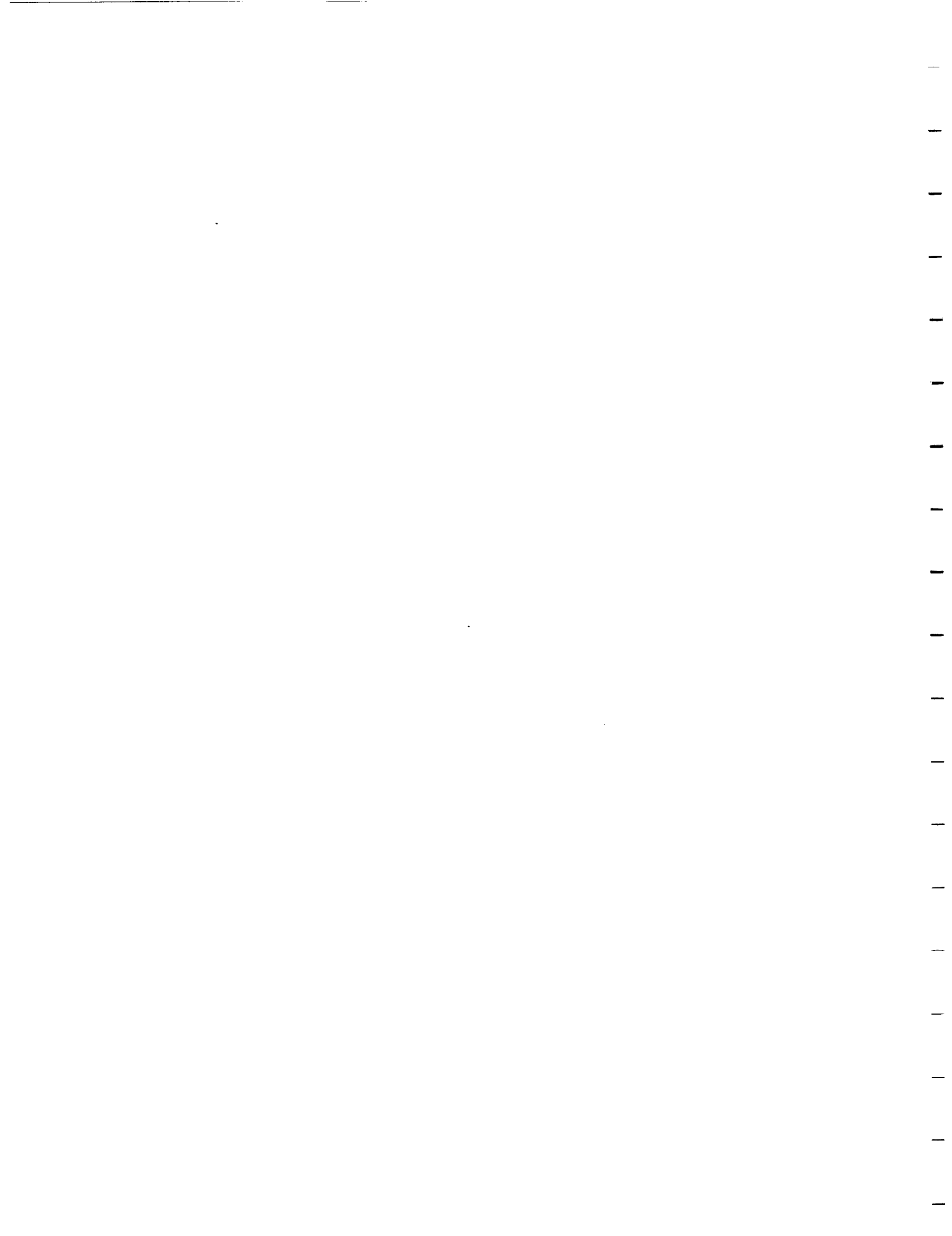
The other likely upgrade will be tools that make communication and collaborative work in the office more effective. One class of tools are programs which structure communication in a work group. Ordinary electronic mail provides an effective channel to pass messages from one person to one or more people in a group. In that environment, however, all messages are treated alike even though they may contain much different content and call for different actions by the recipient. One dimension of that structure, for instance, is for the sender to classify the message in one of a number of fixed categories: information, requests, actions, commitments, etc. Suitably tracked by type, date, and sender, those messages become a definition of an individual's relations with his or her group. Those relations, in turn, define their commitments to others in the group--in short, their work agenda. Such a message and tracking system will be essential as the interlocking relationships in the SSFPO become more complex over time.

Other tools will emerge to assist in the management of this complex and ambitious project. The tools will be effective as they support the type of management processes adopted by the Project Office. Unfortunately, tools cannot create tasks nor accomplish them alone. Tools are just that; they only assist in accomplishing tasks which are conducted by the staff itself.



Appendix I

Proposal



SSPO Integrated Schedule

A Proposal for Prototype Development

submitted to

Amy B. Kennedy
Management Integration Office
Space Station Program Office
NASA Johnson Space Center

prepared by

Peter C. Bishop, Director
Space Business Research Center
University of Houston-Clear Lake

ABSTRACT

The Space Station Program Office (SSPO) at the NASA Johnson Space Center is responsible for managing the contract for Work Package 2 of the U.S. International Space Station. The Office contains seven divisions and is directed by the Projects Manager. The Manager and the division chiefs currently have no common method for establishing and reviewing their milestones and activities among themselves. This task will develop a prototype project management system for this office. The approach will be an iterative prototype development which establishes proposed final and initial baseline systems and iterates both until they converge on the actual final system. The task will require \$40,000 and will last approximately six months.

Background

The Space Station Program Office (SSPO) at the NASA Johnson Space Center (NASA/JSC) is responsible for managing the contract for Work Package 2 of the U.S. International Space Station. Work Package 2 primarily covers the space station's truss structure and the integration of modules and power elements with it, the development of the operational computer information system, and crew selection and training. SSPO at JSC is considered the third level of program management (Level III). It reports directly to the SSPO Level II at Reston, Virginia, which in turn reports to Level I at NASA Headquarters. JSC/SSPO also works closely with the other Level III offices at the Marshall Space Flight Center, Goddard Space Flight Center, and Lewis Research Center which have responsibility for the other work packages in the space station program.

Managing the development of a system as complex as the space station may turn out to be the most complex management task ever attempted. Even managing a work package as multi-dimensional and complex as Work Package 2 is a daunting task. One of the key elements to success therefore will be a continuous and accurate understanding of the objectives, the milestones, and the activities for work that is planned and that which is currently underway. The JSC SSPO clearly needs a project management process to guide its

activities over the next several years of development work. The purpose of this task, therefore, is to prototype such a project management process in an orderly way which is also responsive to the real needs of the Program Office.

Objective

Develop a prototype project management framework for the JSC Space Station Programs Office whereby the Projects Manager and the Division Heads (need proper term here) can jointly establish and review scheduled milestones and activities.

Approach

The Space Business Research has been engaged in research on information management for three years under various contracts with NASA and other organizations. In that time, the Center has developed a methodology for iteratively developing prototype systems. Iterative development attempts to achieve the rational benefits of top-down system design procedures as well as the responsiveness of ad-hoc procedures. The approach is fully described in the appendix to this proposal.

Briefly, the approach is based on the conception of an information system as the interplay of four elements:

Requirements --	the ultimate use of the system
Products --	the output of the system
Configuration --	the system itself including personnel, hardware, software, data structures, procedures, and resources
Data --	the input of the system

The approach begins by specifying the ultimate objective for the system. At the same time, a baseline system is defined by specifying the elements which currently exist and which can be used to achieve the ultimate objective.

Having specified the ultimate objective and the baseline, new prototype elements are developed during a standard iteration period. Each of these new elements is evaluated against the existing baseline and the ultimate objective. Those elements which pass review (i.e., appear to be closer to the ultimate objective than the current elements) will be added to a new baseline. At the same time, the ultimate objective is also modified based on the experience of developing these new elements. Actual requirements may become clearer or resource constraints may require scaling down the objective. In any case, a new objective system and a new baseline are developed for the next iteration.

This process of iterative development requires a rigorous project management and reporting system of its own to guard against the abuse of haphazard activity. The iterative approach does not require specifying all of the steps from the baseline to the objective system. This approach in fact assumes that those steps cannot be known in advance and that specifying them prematurely locks the process into a path which is not sensitive to experience along the way. On the other hand, purely ad-hoc development can often be fruitless by leading to blind alleys and by concentrating on interesting but unimportant elements of the system.

The solution is to rigorously keep track of current baseline and final system elements and include only those elements which represent real progress toward the final system. While no approach is foolproof (as we fools know), this approach attempts to maximize the benefits both of rational planning and of learning from experience.

The Final and Baseline Systems

The first specification of the final and baseline systems will be developed in consultation with all the personnel who will manage and/or be affected by this information system. For the sake of the proposal, however, an initial specification of the system is

valuable. This specification clarifies the approach, and it can be used as the point of departure for discussions with key personnel over their objectives for the system.

The following narrative includes elements of both the final system and the baseline systems. To the extent that the items included are clear and acceptable to the SSPO review team, they will become part of the baseline for this system. If those elements remained unchanged throughout the prototype process, they will become part of the final system. Items in parentheses indicate portions of the ultimate system which still require work and decision. Any portion of this specification, however, is open for discussion and modification based on the experience of building this prototype.

Requirements

The clearest requirement for this information system is that the Projects Manager and his staff have a framework for working on and communicating about project management and scheduling. The framework will include a set of concepts which can be clearly defined at the beginning and which should become habitual over time. The framework would allow each key person to work in an environment where the parameters for managing schedules, milestones, and activities were familiar. The framework would also allow clear and concise communication of these matters among the

key people.

Conversely, the lack of such a framework muddies the process of scheduling and communication because some part of the work or the message must contain information on the framework being employed. Therefore, establishing a useful and consistent framework within this cooperating group will reduce the overhead required to maintain the framework and allow more time for substantive matters. The framework will also increase accountability for managers and contractors.

Products

Two products are currently thought to meet the requirements for a consistent project management framework. The first is a 12-month calendar called the Project Schedule. The Schedule includes the following items:

- . major milestones by Division over time
- . planned activities by Division over time
- . contract support requirements by Division over time

(The level of detail for the Schedule is TBD.)¹ The Schedule also includes the critical path for each major milestone over the

¹Parentheses contain items which are to be determined as the system develops.

planning period.

The second product is a weekly report of milestones and activities called the Scheduling Reporting System (SRS). The SRS reports on the status of milestones and activities from the previous week and a plan for the coming week. It also includes a list of the critical items to be reviewed each week for each Division and for the Office as a whole.

Configuration

The final system assumes at least one key **staff** member with the background and experience to manage this information system. That person should be responsible for orienting new personnel to the concepts and procedures of the system and for supporting the execution of those procedures. (The system may also require clerical personnel for data input and producing standard reports.)

The computer **hardware** for the system be standard TMIS microcomputers. The supporting staff member will use a central computer workstation with the peripherals and software packages necessary to capture, store, manipulate, and report the required information. That workstation will accept data from and be able to send data to the workstations of other key personnel in the Office. (The method for transferring data between workstations is TBD.)

(The project management **software** is TBD.) The software package selected must be able to transfer data between the current

SSPO packages for word processing, spreadsheet, (and telecommunications). (The method for transferring data between software packages is TBD.)

(The **data structures** will be determined jointly by the information which managers want to see in the system products and by the structure of the software package selected for the system.)

The **procedures** cover the operation of the system and the responsible offices for that operation. The Project Schedule will be updated monthly, and the Schedule Reporting System will be updated weekly. The Management Integration Office will integrate the Final Schedule (needs to be defined) and KX will develop and distribute that schedule. (MIO and KX roles need further definition.) The SRS will be used as the basis for weekly management reviews between the Projects Manager and the Division Heads.

The **non-recurring resources** for this system are the cost of the planning activity outlined in this proposal and equipping the workstations with the appropriate software and peripherals as they are selected. The **recurring resources** will include some portion of a staff member qualified in project management procedures and the clerical support required to manage the data.

Data

The data for this system comes from three sources.

- . Level II establishes overall milestones for Level III which are consistent with the orderly development of the space station among the various work packages.
- . The Projects Manager's office allocates those milestones to the various Divisions within the Level III Program Office.
- . The Division Heads establish activities and contractor support requirements to achieve those milestones in the required time.

(The exact nature of the data is a function of the current project management data which is currently being exchanged, the data which managers want to see, and the data which the software package can accept and use.)

Implementation

The first task will be to assemble a prototype development team from contractor personnel and a prototype review team from key SSPO personnel. These teams will work together developing and reviewing iteration products throughout the prototype development process.

Prototype Development Team

Project Manager -- responsible for overall project planning and

coordination

Project Management Expert(s) -- responsible for proposing system elements which conform to state of the practice in project management

Research Assistant(s) -- responsible for collecting data and configuring the system under the supervision of the Project Manager

Prototype Review Team

SSPO personnel who are responsible for selecting elements to be included in the on-going baseline system. These personnel should represent the interest of all SSPO staff involved in the system. They should also be acquainted with project management as it is practiced in SSPO.

The review team will receive the proposed iteration elements and decide on their inclusion into the baseline system in conjunction with the development team.

Activities -- First Iteration

Requirements

- . discuss the review team's requirements and preferences for this system
- . meet with any other SSPO personnel on their requirements and preferences for the system
- . identify local organizations which use project management software

Products

- . review standard project management products

available from the literature

- . review products from standard project management software packages
- . solicit product ideas from SSPO personnel

Configuration

- . solicit job responsibilities and qualifications for project management personnel from local organizations
- . specify TMIS compatible microcomputers
- . survey JSC experience in project management configuration elements
- . obtain reviews of leading project management software for TMIS-compatible microcomputers
- . review current SSPO project management procedures

Data

- . create data dictionary of data elements from current SSPO project management procedures
- . supplement data dictionary with data elements from SSPO personnel requirements and preferences
- . compare data dictionary with data elements in standard microcomputer project management software

Schedule

The project should last six months from the approval of the project. The first month will spent assembling the prototype teams and securing agreement on the ultimate objective for the system and the baseline elements.

Each month thereafter will represent one iteration for a total

of five months. Each iteration period will open with a proposed set of activities designed to move the system elements forward. The development team will work those activities throughout the period. Toward the end of each iteration period, the development team will present its iteration products to the review team. The period will close with the selection of elements for the new baseline.

The period of iterations and the total length of the prototype development process can be adjusted based on circumstances. System elements may be developed more rapidly or more slowly than expected which has an effect on the total length of the prototype period. The cycle time may be too short or too long with adequate work between iterations. The process is flexible enough to accommodate these circumstances.

Appendix II

Information System Plan



Information System Plan

Introduction

An information system is a tool for achieving objectives beyond itself. Although many believe that information or technology is good in its own right, the right information system depends on its intended use. An information system which is excellent for one task may be terrible for another.

The reason for the variability in the quality of an information system is that the system is driven by its requirements as illustrated in Figure 1. The **requirements** enter the system from the environment. The requirement is usually a request for a product (or service) to be delivered in a (usually short) period of time. The **product** will be the output of a hardware/software/-data configuration. The **configuration** in turn contains some **data** along with the tools to produce the product, but also may require more data from other parts of the environment.

The **demand** for information therefore flows from requirements to data. The **information** itself flows back: from data, through the configuration of the system, into products, which satisfy requirements. These four components then determine the nature and

Figure 1

```

*****
*                                     *
*                               ENVIRONMENT                               *
*                                     *
*                                     *
*          Requirements                                Data                *
*                                     *
*          |  ||                                     ||  |                *
*          |  ||                                     ||  |                *
*  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - *
*          |  ||                                     ||  |                *
*          |  ||                                     ||  |                *
*                                     *
*          =====                                =====                *
*          Products                                Configuration            *
*          =====                                =====                *
*                                     *
*                               SYSTEM                               *
*                                     *
*****

```

Page 2

System Development

Developing an information system typically follows one of two courses. Most information systems grow up haphazardly over time in response to requirements which are habitual and expected. These traditional information systems tend to be established, well understood, and responsive to traditional requirements. On the other hand, they do not respond well to new requirements because they are difficult to change. They are also not very efficient nor is it easy to make them more so without starting over.

The other type of information system is created from scratch, usually in conjunction with a new office or function. In this case, developers follow a top-down, intensely rational process--establishing requirements, baselining procedures, testing alternatives, integrating components, and delivering the final system. While systems developed in this fashion tend to be complex and powerful, they are often not useful because the developer (or even the client) failed to understand the "real" requirements. It is only after much time is lost and money spent that the system is understood well enough to design and build the right system.

The Approach

The Space Business Research Center proposes a third alternative for planning an information system. Rather than propose an entire information system at the beginning, the Center conducts a **process** which builds an information system. If one were to propose a complete at the beginning, one would have to make innumerable assumptions about the staff, the computer systems, the procedures, and the requirements of the system. Most of those assumptions would be in error so that the proposed system would not be the correct one.

In contrast, the Center proposes an iterative development process which combines the responsiveness of traditional processes with the rationality of the top-down process. Iterative development is a process for developing a system in a series of steps where the objectives for each step are contingent on the outcomes of previous steps. The overall requirements for an effective information system will be met, but the manner in which they are met will be left up the investigations during the development process. The overall quality of the information system will be continuously measured against the criteria in Table 1.

*	Table 1	*
*		*
*	Information System Criteria	*
*		*
*	Powerful: able to perform functions desired	*
*		*
*	Flexible: able to perform a wide variety of	*
*	functions without re-programming	*
*		*
*	Easy to learn: able to produce results in a	*
*	short time after orientation	*
*		*
*	Easy to use: able to produce results with a	*
*	minimum of effort	*
*		*
*	Cost-effective: able to satisfy these criteria	*
*	at moderate cost	*
*		*

The Implementation

The iterative development process proposed here begins with two key elements: a shared vision of the ultimate objective and a baseline set of components. The ultimate objective is difficult to pin down in a closed, objective sense. While written statements are necessary for specifying the nature of the ultimate objective, they are not sufficient because their unavoidable ambiguity leaves too much room for interpretation. Rather the shared vision must be continually refined in practice, even as the information system is taking shape, through discussion and interaction over specific problems and solutions. The iterative process therefore converges

to the correct solution as the ideal system and the real system simultaneously emerge.

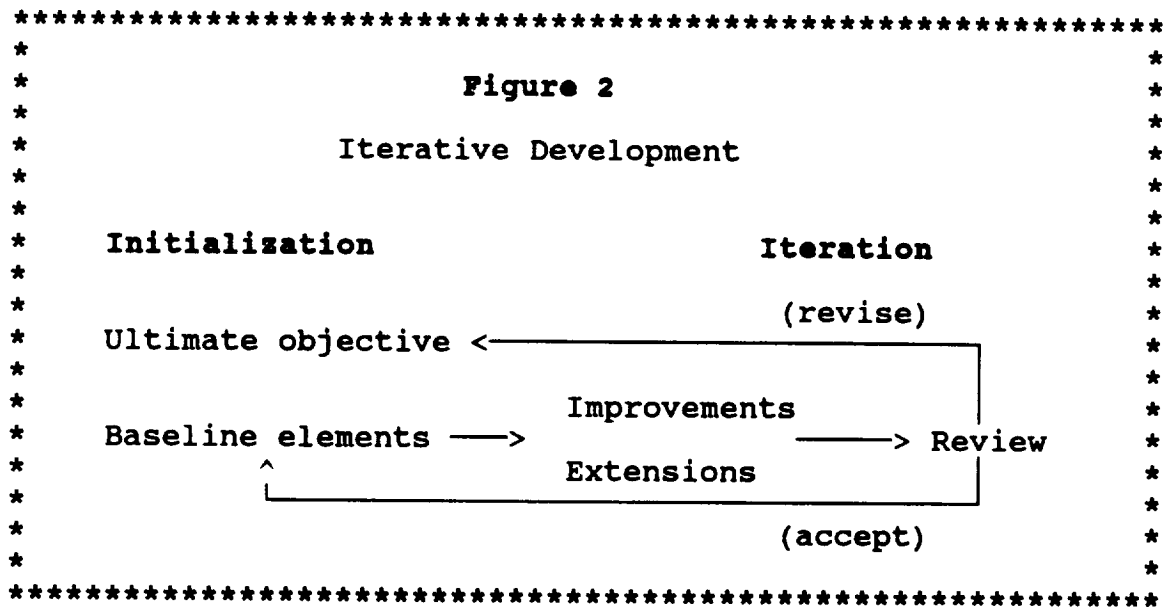
While the shared vision is the objective, the baseline is the beginning. No system arises completely from scratch. A lot is known about each of the components already. The baseline includes what is known and what is available right now. A brief statement of the baseline materials and procedures available for each of the components is included in the later chapters of this proposal.

The first step in this development, therefore, would be to discuss the ideal information system until both the client and the Center have a preliminary understanding of where the process is to go. The first step would also include agreeing on a baseline for each of the five components of the information system:

- | | |
|------------------|-------------------------------------------------------------------------------------------------------------------|
| Requirements -- | what are the demands which the OCST information system is designed to serve? |
| Products -- | what specific products and services should be developed to meet those demands? |
| Configuration -- | what hardware, software, and data structures should the system use to produce the intended products and services? |
| Data -- | what specific data should be captured and how should it be collected and stored in the system? |
| Cost -- | how much will the system cost to develop and to operate? |

7/22/88

Once the ultimate objective and the baseline are established, the process begins to iterate the development of all the components. Each iteration includes work toward improving each of the system elements (such as refining requirements, producing products, configuring systems, and capturing data). It also includes an in-depth review of the improvements produced against the criteria for the information system listed above. Whatever elements meet those criteria are incorporated into the baseline, forming a new baseline, which is in turn the basis for the next iteration.



One key element in this system, therefore, is that real, usable elements are produced at each stage of iteration. In some cases, the outcome may be further understanding (of the

requirements, for instance). In most cases, however, each iteration produces useful products, configuration elements, or data which will become part of the ultimate system. These outcomes are actual "pieces of the puzzle". Real products are produced, real demands met, real systems configured, real data captured so that understanding and evaluation can proceed from the use of real components rather than those merely imagined.

The review of these elements, however, is just as important in order to avoid the danger that products and configuration elements are developed which do not meet a specific requirement, are incompatible with other elements, or are beyond the cost constraints of the system. The exact frequency of iterations may vary. In the beginning, it would be better to have many reviews (e.g., once a month) rather than too few. Less frequent iterations might be acceptable later in the process when common understanding is achieved and tasks do not require as close a scrutiny.

Appendix III

Chronology of Major Events

Space Station Project Office

Working Group Meetings and Interviews

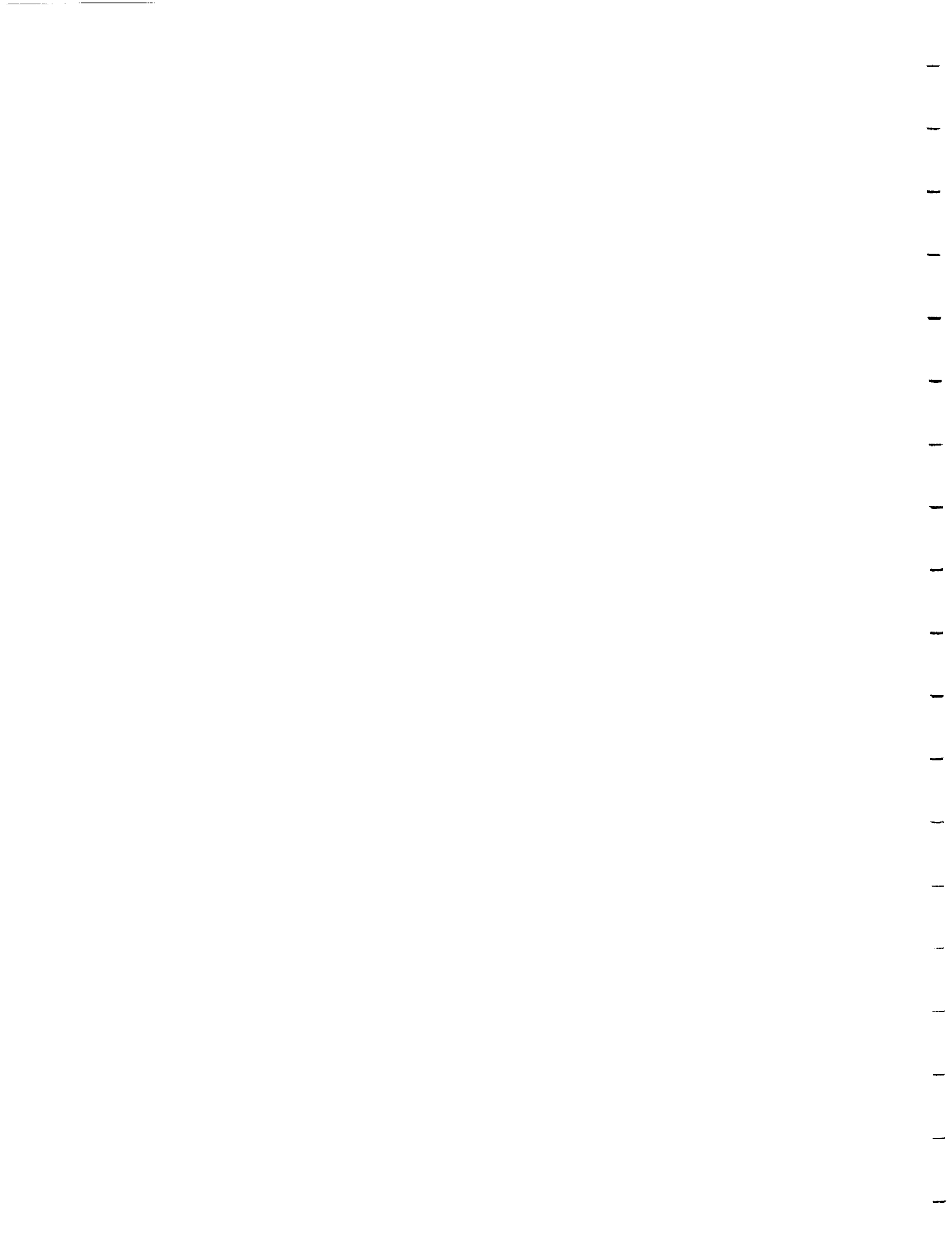
- 1) *August 9, 1988* Working Group Meeting, Carl Shelley
- 2) *August 25, 1988* Interviews with Managers:
 - A) KC/Systems Engineering and Integration, Tony Redding
 - B) KD/Manufacturing and Testing, Ed Armstrong and Bill Andrews
 - C) KB/Flight Elements, Bill Creasy
 - D) KG/Information Systems, Carroll Dawson
- 3) *August 29, 1988* Interviews with Managers:
 - A) KX/Projects Control, Pete Cleary and Gatha Moore
 - B) KG/Information Systems, Gary Raines
 - C) KO/Operations Integration, Ed Kenyon and Gordon Ducote
 - D) MacDonnell Douglas, Jerry Swain
Eagle, Bill Mattigan
- 4) *September 1, 1988* Interview with Manager for Development, Bob Bobola
- 5) *October 20, 1988* Working Group Meeting, Presentation of Study
Progress by Dr. Bishop and Dr. Gardner's Demonstration
- 6) *October 28, 1988* Working Group Meeting, Follow up to gather feedback
from the working group
- 7) *November 15, 1988* McDonnell Douglas demonstration of project
management software by Advanced Management
Solutions
- 8) *November 16, 1988* McDonnell Douglas demonstration of scheduling
software All-in-One.



Appendix IV

Baseline Elements

10/28/88



**SPACE STATION PROJECT OFFICE
INTEGRATED SCHEDULE SYSTEM**

Baseline Elements

10/28/88

1. REQUIREMENTS

1.1. Better/easier creation and manipulation of schedules

1.1.1. Preparation and manipulation of office-level schedules can be left to the individual office managers for the time being. They can use a common system for their own use but do not have to. They only have to report in a common system.

1.1.2. PERT/CPM logic is not required

2. Better/easier coordination of schedules

2.0.1. Little coordination is required between the individual offices at this time. Informal systems seem to work well enough.

2.1. Better/easier communication of schedules

2.1.1. Of the four requirements, communication of schedules is the most important

2.1.2. The problem is not so much scheduling as information management about schedules between project office and individual office managers

2.1.3. Aim is to improve communications to top management

2. PRODUCTS

2.1 Milestones (24-month event table: Milestones, Activities, and Reviews)

- 2.1.1 Update weekly
- 2.1.2 Must include office-level milestones necessary to support next major program milestone (PRR, PDR,.....)
- 2.1.3 Managers may use WBS (Level 6 or 7) or establish own set of activity areas
- 2.1.4 Must be able to move, link, and rank milestones
- 2.1.5 Report in common GANT chart format
 - 2.1.5.1 Highlight key milestones
 - 2.1.5.2 Need percent complete
 - 2.1.5.3 Need ability to attach notes

2.2 Actions

- 2.2.1 Program and Project actions which are not directly related to program milestones
- 2.2.2 Contractor documents submitted for review
- 2.2.3 Change requests for review
- 2.2.4 Critical milestones which emerge from EMS analysis

2.2.5 Each action includes

- 2.2.5.1 ID
- 2.2.5.2 Type (Program, Project, Document,
CR,....)
- 2.2.5.3 Title
- 2.2.5.4 Description
- 2.2.5.5 Primary organization responsible (OPR)
- 2.2.5.6 Start time
- 2.2.5.7 Deliverable
- 2.2.5.8 Due date

2.2.6 Reports by

- 2.2.6.1 Individual item
- 2.2.6.2 Type, organization, time,....

2.3 Meetings

2.3.1 3-month meeting calendar

- 2.3.1.1 Periodic program and project meetings
- 2.3.1.2 Ad hoc meetings which involve personnel
from more than one office
- 2.3.1.3 Time, people, rooms...
- 2.3.1.4 Updated daily

3. DATA (Source)**3.1 Milestones and Deliverables**

- 3.1.1 Level II Program Office (TBD)
- 3.1.2 Level III Project Office (TBD)
- 3.1.3 Office level activity areas (WBS Level 6
or 7 or manager's choice) (Office Mgrs)
- 3.1.5 POP process (W Whittington)

3.2 Actions (Activities and Tasks)

- 3.2.1 Level II Program Office (TBD)
- 3.2.2 Level III Project Office (TBD)
- 3.2.3 Contractor documents received for review (TBD)
- 3.2.4 Reviews for CCB (B Beasley)
- 3.2.5 EMS critical path elements (J Ryan)

3.3 Meetings and Presentations

- 3.3.1 Periodic Program and Project meetings (TBD)
- 3.3.2 Ad hoc meetings which involve personnel from
more than one office (TBD)

3.4 Start, duration, end times for above**3.5 Links between above**

4. Configuration

4.1. Operations

4.1.1. Milestones

4.1.1.1. Initialize the Milestone system

4.1.1.1.1 Each Office develops its Schedule

4.1.1.1.1.1 Establish an Activity list

4.1.1.1.1.2 Establish an event/Milestone list
for each activity

4.1.1.1.1.3 Present Schedule to Project Office

4.1.1.1.1.4 Present Schedule to Target Group

4.1.1.2 Run the System

4.1.1.2. Each office presents schedule Delta's to Schedule office

4.1.1.2.1. Schedule office prepares overall briefing
for Project Office and Target Group

4.1.1.2.2. Each Office briefs Target Group on its
critical Delta's

4.1.1.2.3. Project Manager selects critical Delta's
for additional discussion

4.1.1.2.4. Schedule office distributes hardcopy of
updated schedule

4.1.2. Actions**4.1.2.1. Initialize the Action system**

- 4.1.2.1.1. Project Office identifies types of Actions and Sources to monitor activity of each type

4.1.2.2. Run the Action system**4.1.2.2.1. Create an action**

- 4.1.2.2.1.1. Source sends notice (and material) to the Actor
- 4.1.2.2.1.2. Source sends a Create Notice to the Action office

4.1.2.2.2. Complete an action

- 4.1.2.2.2.1. Actor sends notice (and material) to the Source
- 4.1.2.2.2.2. Actor sends Complete Notice to the Action office
- 4.1.2.2.2.3. Source sends Verify Notice to the Action office

4.1.3. Meeting system**4.1.3.1. Initialize the Meeting system****4.1.3.1.1. Create list of Periodic meetings**

- 4.1.3.1.1.1. Meeting office develops list of Periodic project meetings
- 4.1.3.1.1.2. Each Office proposes additional meetings for the list
- 4.1.3.1.1.3. Project Manager approves list of Periodic Meetings along with their times, rooms, and attenders

4.1.3.2. Run the Meeting system

4.1.3.2.1. Create Ad Hoc meeting

4.1.3.2.1.1. Office or authorized individual submits a request for an Ad Hoc meeting to the Meeting system

4.1.3.2.1.2. Meeting system posts the meeting as tentative and sends notice to proposed attenders

4.1.3.2.1.3. Attenders may respond within 24 hours by

4.1.3.2.1.3.1. Confirm attendance (default when no response)

4.1.3.2.1.3.2. Report conflict

4.1.3.2.1.3.3. Indicate no-show

4.1.3.2.1.4. Meeting system reports results to Requestor

4.1.3.2.1.5. Request responds within 24 hours by

4.1.3.2.1.5.1. Confirm meeting

4.1.3.2.1.5.2. Request change in schedule or attenders

4.1.3.2.1.5.3. Cancel meeting (default when no response)

4.1.3.2.1.6. If confirm, Meeting system posts meeting as scheduled

4.1.3.2.2. Meeting office posts list of tentative and confirmed meetings

4.2. Software

Requirements

Operate in network

Import/export standard file formats

Move, link, prioritize milestones

Reports

Gantt

Planning calendar

Meeting Scheduler

Tracking action items

Thirty products reviewed

Can't get all requirements in one package

Fifteen products left to be reviewed

Best bets

Super Project Expert

Lotus Agenda

Who, What, When

Conclusions

Need at least two software products

Maintenance will be required

Training of new users

Customizing programs

Data base structure will likely evolve over time

All products are new, major upgrades on horizon

4.3. Hardware

Need AT class machine

Hard Drive

EGA color monitor

Laser Jet printer

Support for Novell, 3 Com networks

4.4. Communication media (network preferred for all)**4.4.1. Schedule**

4.4.1.1. Hardcopy Gantt charts

4.4.2. Action

4.4.2.1 Input

4.4.2.1.1 Telephone

4.4.2.1.2 E-mail

4.4.2.1.3 Memorandum

4.4.2.2 Output

4.4.2.2.1 Hardcopy

4.4.2.2.2 E-mail

4.4.2.2.3 Diskette

4.4.3. Meetings

4.4.3.1 Input

4.4.3.1.1 Telephone

4.4.3.1.2 E-mail

4.4.3.1.3 Memorandum

4.4.3.2 Output

4.4.3.2.1 Hardcopy schedules

4.4.3.2.2 E-mail

4.4.3.2.3 Diskette

5. Personnel

4.5.1 Management authority

4.5.2 Program analyst

4.5.3 Operator

5.0 COST (Money & Time)

5.1 Non-recurring

5.1.1 Planning task

5.1.2 Dedicated Hardware

5.1.2.1 LAN (if distributed, real time processing)

5.1.3 Software

5.1.3.1 N copies of software (if distributed)

5.1.4 Initial overview and training

5.1.4.1 Management training

5.1.5 Learning

5.2 Recurring

5.2.1 Dedicated person and contractor support

5.2.2 Hardware and software maintenance

5.2.3 Constructing schedules and resolving conflicts

5.2.4 Overview and training for new personnel

Definition of terms

Office: an organizational unit which is recognized as part of the proposed system

KA -- Project Office
 . Manager
 . Manager for Development
 . Manager for Integration

KB -- Flight Elements

KC -- Systems Engineering and Integration

KD -- Manufacturing and Test

KO -- Operations Integration

KG -- Information Systems

KX -- Projects Control
 . Resources Management
 . Performance and Configuration Management

Schedule: a collection of Activity areas within a specific Office

Activity: a collection of events/milestones supporting one objective

Event: a milestone (start, review, finish)

Level II -- PRR, PDR, CDR, ...

Level III -- PMR, ...

Schedule office: the individuals and tools responsible for carrying out the Schedule operations

Action: the directive to accomplish a task

Level II

Level III

Document reviews

Configuration Control Review

Source: an individual or Office that may initiate an action
and verify its completion

Actor: an individual or Office that is responsible for
completing the Action

Action office: the individuals and tools responsible for
carrying out the Schedule operations

Meeting: the planned interaction of two or more individuals
and tools from different Offices within the Target
Group

Meeting office: the individuals and tools responsible for
carrying out the Meeting operations

Appendix V

Evaluation of Project Management Tools

prepared by

Dr. Everrette C. Gardner

Dr. Dennis A. Adams

Department of Decision and Information Sciences

University of Houston

20 December 1988

FINAL REPORT
SPACE STATION PROGRAM OFFICE
SCHEDULING AND TRACKING SYSTEM

Everette S. Gardner, Jr. and Dennis Adams

This report completes the work under subcontract number 023, project number IM.12. Our tasks were (1) to determine software requirements for the scheduling and tracking system and (2) to evaluate commercial software packages to meet those requirements. It was agreed that no software development would be undertaken in this project.

REQUIREMENTS

The initial requirements stated that the system should allow for better/easier creation, manipulation, coordination, and communication of schedules. But in the course of interviews with NASA personnel, we became convinced that the issue is not so much scheduling but information management. A very sophisticated scheduling system is already available on a mainframe system.

Since the mainframe-generated schedule is very complex, one requirement is finding some easy way to track critical segments of the established schedule. Another requirement is to track action items imposed on SSPO by higher authority. Some managers also expressed the need to track action items internal to SSPO. Minor requirements include the need to generate monthly planning calendars and meeting schedules.

The only way to share timely information is through a computer network. Thus we looked for software that was network-capable. Since NASA relies on mainframe ARTEMIS software for project management, we wanted a program compatible with ARTEMIS data. Other specific requirements include the ability to:

- Import/export other standard file formats
- Move/link/prioritize milestones
- Attach notes to milestones
- Report the percent complete for a schedule segment
- Produce graphics, including Gantt charts of milestones
- Assign and track action items

Finally, the most critical requirement was ease of use. We feel strongly that managers should have personal access to the software. Data entry could be delegated but managers should be able to manipulate schedules directly. Why? Scheduling requires judgment calls which can only come from management.

SOFTWARE REVIEWS

Enclosed are notes on 41 PC software packages that were tested for this project. Many other PC packages were considered but not tested since they obviously did not meet our requirements. We could find no mainframe or mini-computer software that met these requirements, even approximately.

We did not prepare charts comparing advantages and disadvantages of the various software packages since the best choices for SSPO are clear. We recommend that SSPO adopt two programs, Time Line and Agenda.

TIME LINE

First, a project management program must be considered because of the need for graphic displays of schedule information. There are many excellent programs in this category. The best choice for SSPO is Time Line.

Time Line is one of two project managers that provide direct compatibility with ARTEMIS. The other is the PC version of ARTEMIS, a ridiculously cumbersome program that was ruled out early in the project.

We rate Time Line as very easy to use. The program produces beautiful Gantt charts similar to the charts in current use at SSPO. The Gantt charts and all other program reports can be automated with macros so that production is virtually hands-off. From the manager's point of view, Time Line is attractive because it has an intuitive interface, the outline. That is, tasks are organized by simply indenting them under higher-level tasks. This is done in Gantt-chart form. The process is quick and easy, much easier than any other program tested.

Moving/linking/prioritizing milestones is straightforward in Time Line. Many potential users asked for the capability to attach notes to tasks and milestones. Time Line has a handy pop-up notepad for this purpose. Percent complete calculations are automatic. We tested import/export capability for LOTUS and ASCII files with good results.

A network version of Time Line is in beta testing and should be available in January, 1989. We realize of course that it will be

some time before SSPO has a complete network in place. The important point is that Time Line will be able to accommodate any standard network.

Thus we conclude that Time Line meets every requirement listed above except those of assigning/tracking action items and calendaring. But how would Time Line really help the manager do his or her job? Here is a synopsis of how the program would be used. Managers would work with the outlining interface to experiment with different schedules for a complete project or a segment of a larger project. Once the project was organized, the manager would delegate updating and schedule maintenance. Periodically, the manager would compare actual progress to the plan via on-line Gantt charts. "What-if" analysis of alternative solutions to schedule problems would be easy, since the manager could move milestones with the cursor keys and see immediately the impact on the overall schedule. The macros could be used to produce hard-copy Gantt charts and reports.

All this may sound rather simple but it can get complex very quickly on a computer. The outline interface and the ability to make instant changes to graphic displays of the schedule are the keys to making it work.

Time Line would also be useful for the standard, organization-wide schedules in circulation at SSPO. Again, the macros automate a great deal of repetitive clerical work.

AGENDA

To select software for tracking action items, we first had to define exactly what this function means. SSPO does not have a formal definition of this function. Here is our definition:

"Tracking" is the job of organizing unstructured, rapidly-changing information into a form useful to managers.

Lotus Agenda is the best choice for this job, with Action Tracker a close second. We recommend Agenda because it has extensive macro capabilities and is supported by Lotus while Action Tracker is from a small company with no track record.

Agenda is such a flexible program that it is difficult to describe without detailed examples. A video was provided to SSPO during the course of the project to help potential users get an understanding of program concepts.

A network version of Agenda is not yet available. However, we expect a network version well before SSPO has network capability in place.

Agenda monitors four basic elements of information: items, categories, notes, and views. Items are free-form text strings. Items are assigned to categories based on conditions you specify. Using artificial intelligence techniques, Agenda can also make these assignments automatically. You can add extensive notes to items. A view is an arrangement of a group of items by one or more categories. For example, you could create a view of urgent action items, perhaps ordered by date or by person responsible. Or you could create another view to monitor all the action items assigned to one person or organizational unit.

You can switch views instantly and filter the information shown. For example, you can screen out all action items due beyond certain dates.

How would SSPO use Agenda? Standard views would be created by person, organizational unit, urgency, and source of the item. New action items would be added to the system and Agenda would automatically file them for display in the correct view. Feedback on status and completed items would also be filed automatically. The system would automatically print out reminders and status reports. Also, at any time, a manager could access Agenda and check the status of action items on-line.

Perhaps the most exciting feature of Agenda is its ability to automatically read and file all electronic mail communications. This feature would remove a considerable administrative burden from electronic mail users.

CALENDARING PROGRAMS

Although we looked at many alternatives, we could find no better program for scheduling meetings than PROFS, which is currently in limited use at SSPO. We realize that many people at SSPO don't like PROFS. We think the reason is that management has never made a commitment to PROFS.

Who, What, and When (WWW) is a PC-based alternative to PROFS that does about the same thing and is about as easy to use. We are reluctant to recommend replace of PROFS with WWW since it is not clear what SSPO would gain in the short run. WWW is available in a network version. When a network is installed, SSPO may want to reconsider WWW.

The final requirement is for a program to prepare meeting calendars. We were unable to find any software that does a satisfactory job in this area. Fortunately, this seems to be a very minor problem.

IMPLEMENTATION

Our experience is new software systems fail without senior management commitment. SSPO must get senior managers involved in any software implementation.

InstaPlan 1.03B

InstaPlan uses a command interface reminiscent of Lotus 1-2-3 (eg., pressing the Slash key brings up a command menu). Aside from the commands used for filling and editing the lists of tasks and resources, you can view the data as a PERT chart, a Gantt chart, and a "load chart," or resource-distribution histogram.

The on-screen PERT chart is actually a three-tiered vertical WBS in a screen window. The task currently highlighted in the task list is in the middle of the window, with its predecessors boxed above it and its successors boxed below it. Critical path connections appear as double lines, and you can see more of the chart by scrolling through the list. The histogram highlights overload situations, where resource demand exceeds supply, and you can assign separate calendars to each resource.

The optional tracking module lets you save your initial plan as a "reference plan," and then you can update the working version of the plan with ongoing completion data, using the spreadsheet view. Subsequent Gantt charts will then show the current plot and the baseline plot of each task, so that problem areas will stand out.

The PERT-module option prints beautiful charts, complete with a symbol key and even a "sign-off block," as is normally included in the corners of blueprints for an approval signature. The charts come out lengthwise on multiple sheets, which you reassemble.

The Gantt charts are equally handsome, although the bars are so large that only eight tasks fit on a page. Relationship lines also connect the bars in the Gantt chart. InstaPlan covers the basics, but it doesn't have task prioritizing and it doesn't support plotters. It also doesn't let you specify multiple time estimates, but neither do most packages in this price range.

Timepiece 1.3

When inputting resource data in Timepiece, you update the default setting, which says, for example, "cost type: variable. \$500 per day. hours available per day: 8." If you change "variable" to "fixed," the rest of the field disappears, since it no longer applies. When defining tasks, you can assign resources to them as you go along, selecting them from a pop-up menu that shows which resources you previously listed.

Alternately, you can define the project by drawing a network chart on -screen, instead of listing the factors and having the computer draw the chart. You start with a chart on the screen showing Start, End, and a task box in between them. You can name and define multiple tasks, listing precedence relationships as you proceed, and Timepiece draws them in as you go along. While Timepiece adds tasks from left to right, you can nudge them up and down if the screen gets cluttered.

Timepiece supports only two calendars per project and has no automatic resource leveling. It can do variance reporting, but it won't allow multiple time estimates. For project reporting, there are 19 canned report formats,

with various options and levels of detail. You also can update the plan with percentages, completion dates and actual costs, so you can track an ongoing project.

Timepiece is undemanding--you don't have to know much about the software to use it, and for that matter, you don't have to know much about project management. It seems aimed at middle managers who need to spend time where the actual work is happening rather than learning software and fiddling with schedules, and its graphical user interface makes Timepiece easy to use.

Pertmaster Advance 2.0

Pertmaster Advance supports up to two graphs at once in half-screen windows. If you have, say a resource-distribution histogram showing some overload, you can place it at the bottom of the screen. At the top of the screen you open a Gantt chart showing only those tasks involving the overloaded resource. Then you set the two graphs to the same time scale with the same starting point, so that they track each other.

Next you can go into the Gantt chart and move one of the bars. This capability is unique among these packages--the software usually arranges the bars in response to your scheduling data. The tasks linked to that task rearrange themselves, and if you've affected the resource demand, the histogram changes. So you can move bars on the Gantt chart back and forth until the histogram no longer shows a problem.

An alternative is to trust Pertmaster Advance's resource-leveling 'plan fit' command. If there is no required finish date, it can make everything fit. Otherwise, the program may leave some resources overcommitted.

You can assign separate calendars to each task and resource, and you can have resources and subresources. Examples include assigning workers to crews, trucks to crews, and drivers to trucks.

Pertmaster Advance can track ongoing projects and show variances. It also offers a mix of standard reports, including one numerical table that shows the demand for each resource on each day. But it doesn't let you create multiple time estimates.

PMS-II8.1

The six submodules define the resource database, material delivery scheduling, graphics printer support, color plotter support, a report generator, and batch-processing macros for unattended operation.

The material-scheduling submodule--unique among the packages I reviewed--is designed not only to let you know when to order things, but to help pool orders to get the best quantity discounts.

You can define only one calendar per project. Each activity on the network diagram can have a text note appended to it recording your planning assumptions, interactions with contractors, or whatever you want. The report

generator includes a database-type language with IF...THEN...ELSE logic to define report parameters. You can divide resource costs between general and administrative budgets.

Amid all its features, PMS-II makes no effort to achieve a sophisticated user interface--PMS-II worries about your data, not about you. And for a system with its price tag, you'd expect automatic resource leveling, but it's not there.

Pro Path Plus 1.0 Level 26

Pro Path Plus uses a pop-up menu user interface, and it can produce reports on cash flow, project milestones, and expected completion dates. It also generates to-do lists and Gantt charts. You can reduce the time scale of the Gantt charts from yearly down to quarter-hour increments, with each character representing 15 minutes. On-screen, you can change the time scale by pressing the Plus or Minus key.

You can also create Gantt charts with one of three different time lengths for each task: the expected time, an optimistic time, and a pessimistic time. From these three values, it predicts a fourth, the duration you can expect within 50 percent accuracy, and produces a Gantt chart. It then prints a report with a list of possible completion dates for each task and the chance of finishing by that date. Printouts are limited to typewriter-style graphics, however.

Pro Path Plus does automatic resource leveling by delaying one or more tasks associated with an overloaded resource. ON the Gantt chart, it marks the tasks it delays with one "r" symbol for each unit of time that it has delayed the task. If what you see on the chart confuses you, pressing F1 brings up a symbol legend.

SuperProject Expert 1.0

Like Lotus 1-2-3, SuperProject Expert uses the Slash key to invoke a command menu. You select options, like what chart to display, from pop-up menus. You can also compile project information in an "outline" screen, and you can switch from there to a Gantt chart, PERT chart, WBS, or resource-distribution histogram. The PERT-chart screen is somewhat interactive--you can "scroll" from one task to another with the arrow keys, and pertinent information for that task appears in a pop-up box. YOU can also change this information on the fly and thus edit the chart as you go along.

Each chart's scale is changeable. This includes changing not only the time scale in a Gantt chart, but also the size of each task box in a PERT chart. YOU can reduce the size of the boxes until there is only enough room for the task ID number, making more of the project visible on the display.

You can also specify optimistic, pessimistic, and likely durations and output them in Gantt-chart format. With this option, the software calculates the expected duration (i.e., the optimistic, the pessimistic, and four times the likely duration, divided by 6), which it the uses for most other

calculations.

When tracking a project's progress, each task can have six different conditions: scheduled for the future, started late, in progress, interrupted, completed, and finished late. The program does automatic resource leveling and can report variances. Also, you can have a separate calendar for the project and one for each resource. SuperProject Expert also includes a macro language that automates repetitive tasks or lets you set up unattended batch processing.

Topdown Project Planner 1.01

You can go into a screen mode that shows the boxes without any text. In this mode, you can see, drawn in miniature within the boxes, the charts for the next level. Perhaps mercifully, you can't see to the third level.

You can assign tasks priorities, and automatic resource leveling is available, although you can't perform variance tracking. The latter works by delaying tasks with lower priorities. The manual suggests resolving obvious conflicts by assigning priorities and then letting the computer take over, but it warns that resource leveling should be used with care because it can cause major rescheduling for noncritical tasks. In the real world, such changes can make a schedule difficult to implement. Automatic resource leveling is still useful, however, as long as you make provisions for making some manual adjustments.

Topdown Project Planner can combine two graphs on one page, like a Gantt chart on top of a cumulative cost chart, and can set both to the same time scale. You could also have a Gantt chart with a daily cost projection below it, for budgeting purposes, or a Gantt chart with a histogram below it, so you could spot overloads and immediately see the source. Printouts are essentially screen displays scaled to fit a page, and they require a graphics printer.

The program also lets you track progress on a project, and the Gantt charts reflect what has been done. You also can assign a calendar to each resource and append text notes to each task on-screen. The only thing I didn't like is that Topdown Project Planner limits each PERT chart to one screen. By contrasts, other programs let you create charts that are bigger than your display.

ViewPoint 3.0

When you start defining a project in ViewPoint, you see a screen with a blank work area and a cross-hair cursor that you can move with a mouse or cursor movement keys. The date counter in the corner moves forward as the cursor moves right, and backward as it moves left. You move the cursor to a likely date, press the Plus key on the numeric keypad, and up pops a window. Press T, for task, and a "task description window" pops up. You fill in the information, and a box representing that task appears on-screen.

After entering a few tasks, you assign precedences by drawing lines between the boxes. To establish a finish-to-start relation, you draw from the right (finish side) of the first box to the left (start side) of the other. If the new line is part of the critical path, the line appears in red.

You can play with the layout of the network and with the task data until you get what you want. After you define a list of resources, you can assign them to tasks by a simple point-and-shoot method: You highlight the task, call up the pop-up resource list, and highlight the resource.

You can also "constrain" resources graphically. On the resource -distribution histogram, you can draw a line at what ever level you want to limit the resource to. You can move the line up and down as you go left to right, reflecting any changes you expect. ViewPoint then does resource leveling, changing the end date or eating up the available float to push tasks to a point on the time line where they can get the resource they need.

Micro Planner for Windows

You build projects in Micro Planner by drawing a network mode. The model looks like a flowchart or a PERT (program Evaluation and Review Technique) chart, but unlike the traditional approach, events are represented by circles and tasks are the arrows running between them. You draw the arrows by clicking the mouse on a circle and dragging a straight line left or right. Activities flowing into events from the left must occur before activities flowing out to the right. Events are merely points in time--the glue between activities. In spite of what the name events implies, they do not involve any action and don't take any time.

After the network model is drawn, durations entered, and a project start date chosen, you can run an analysis operation that checks the model's logic. If everything is properly linked, the program calculates the earliest and latest start and end dates for each activity. For each linkage problem it finds, Micro Planner displays an error message box. After Micro Planner analyzes what's been done so far, you can view the project as a Gantt chart. Although this quickly-generated Gantt chart gives you a sense of the project's pattern, it has the task name written through it, which makes it visually unappealing. A much more attractive Gantt chart is available on the report menu.

Because of Windows, Micro Planner is easy to operate. Yet it's not particularly easy to use. The distinction here stems from the program's use of the network diagram as the chief organizing tool for a project and the rich capability it has in accommodating activity types and resource usage. Micro Planner is a program that really makes you think your projects through. The reward for doing this is likely to be better-planned or more-flexible projects. On the down side, the program uses a limited time scale, its cost-analysis features could be better (there is no earned-value report, for one), and it allows too few resources per project. But if you want to model complex projects with the touch of a mouse, are wedded to the Windows environment, and have a mixed-hardware environment, Micro Planner is well worth your consideration.

Microsoft Project

As a testament to its simplicity, Microsoft Project offers the minimum number of screens and program commands that you would need to lay out a project. Ten screens show a Gantt chart or comparative Gantt charts, a network diagram, a resource table, daily and hourly calendars, single- and dual-resource histograms, a histogram with a Gantt chart, and a report form. Each screen has a menu of commands at the bottom. Different combinations of the 24 top-level commands offered by the program appear on the various menus, where their function is tailored for a particular screen. You can invoke most program functions by working your way through one or two menu levels and, if necessary, filling in some command fields. Because the range of screen views and commands is kept to a minimum, you will quickly feel comfortable using the program.

Microsoft Project is simple on a functional level as well. A blank Gantt chart appears when you start the program. To enter tasks, you first press Enter on the already highlighted Edit command. The lower third of the screen is now filled by the activity entry form, where you enter a name, WBS (work breakdown structure) code, duration (scaled in minutes to months), start date, end date, predecessors, priority, percent completed, up to eight resources, and the amount of their use. That's all there is to it. You can continue to add activities one after the other by using the Cursor Down key to open up another blank form and move the cursor bar down the Gantt screen.

Harvard Project Manager 3.0

Harvard Project Manager 3.0 has followed the same developmental trajectory as its principal competitors in the under-\$595 price range. By adding two new ways to build a project, outlining, and a hybrid of the Gantt and PERT (Program Evaluation and Review Technique) charts, Software Publishing Corp. is trying to accommodate a greater variety of users. At the same time, the company has strengthened the reporting, resource, and cost features of the program to make it even more appealing to experienced project managers.

The most interesting addition to Harvard Project Manager 3.0, which we looked at in its beta release, is Fast Track, the new default approach to building a project schedule. Its name announces Software Publishing's hope that it will give novice users a leg up to the world of planning.

The main failings of the program are its weak PERT chart diagram, the small number of resources it allows per activity, and its limited resource-leveling capabilities. Still, such powerful new features as a custom report writer and a WBS field, combined with its simplicity, make the program a good choice for newcomers to project management who need to get up to speed in a hurry.

SuperProject Plus

Computer Associates International's SuperProject Plus is an extremely flexible program, rich in ways to view a project. In addition to the Gantt and PERT charts and the task and resource detail screens in earlier releases, Version 3.0 has an outline screen, a WBS (work breakdown structure) chart, and a resource histogram. Each screen also has alternate views. For example, the task Gantt chart can be seen in outline form--with or without resources shown--or as a basic task chart. SuperProject Plus 3.0 also inherits and extends the operational pliancy of earlier versions with new preference settings for things like evaluation diagnostics and "must" dates. Other enhancements include the following: a new menu system using slash commands as in Lotus 1-2-3; extra schedule types, such as "as late as possible" (ALAP); control over the column order in reports; and the ability to print Gantt charts for a specified date range. Even the price has been improved: at \$395, Version 3.0 is \$100 cheaper than its predecessor.

SuperProject Plus's reports are a powerful part of its project-tracking facilities. There are 15 report types that you can vary to generate 27 different reports. In addition, because you can pick report fields by exact values or within a range of values and apply selection criteria using Only, And, Or, and None, you can tailor your output to your needs. You can sort your data by up to three levels, and you can specify the column order. You can also name your various criteria selections and save them for repeated use.

SuperProject Plus's failings are few. Perhaps the most important are its relegation of multiple projects to subproject status and its inability to level resources across these subprojects. The Gantt chart could also be better. Because the task bars sit on top of the other, with no spacing between them (if the dates overlap), it can be difficult to quickly grasp the meaning of the bar pattern. Also, the note field is limited, and tasks and resources can't be scheduled in minutes.

Although you'll have to spend a considerable amount of time to learn how to use SuperProject Plus's many features, it's worth the extra effort. Well-rounded and flexible, the program offers a multitude of ways to view a project at a multitude of skill levels.

Time Line

Time Line, Version 3.0, is the first new version of Symantec Corp.'s product since 1985. This is a long period of stasis for a program--even one as excellent as Time Line 2.0. but at least the last 3 years have been productive. Time Line 3.0, which costs \$595, is even more versatile and easy to use than its predecessor.

One of the most important changes to the program is its use of outlining as a planning tool. It gives users a familiar and logical way to organize projects. In addition, the new version lets you customize the nongraphic information on Gantt charts and enter tasks from PERT charts. Time Line's reporting function is now more flexible, scheduling can be effort-driven as well as time-driven, and there are additional command shortcuts, expanded notes, and more.

Time Line 3.0 uses outlining as a project organization technique. You can create a task outline directly on a Gantt chart, which is the central graphic view of a project. To do this you indent sublevel tasks, as you would in a normal outline. Indented tasks become children of the parent task that sits above them, which means that their costs and duration are aggregated at the parent level. If there are more than two levels, everything indented under a top-level task is known as a family. You can have as many levels as you want. On the Gantt chart itself, parent or summary tasks are represented by a bar composed of three broken lines. In contrast, detail task bars are solid. Summarizing costs and durations helps you to think about a project in manageable chunks or phases.

At the heart of project tracking are Time Line's reporting facilities. With the use of selectable task data columns on the Gantt chart, and improved filtering and sorting functions, you can generate a nice variety of customized reports. The outline structure also helps because it lets you do summary or detail reporting at various levels. There are five basic report types: Gantt, status, cross tab, resource, and network. Customized report formats can be copied from one schedule to another.

Even with all these useful additions, Time Line 3.0 has its failings. You are allowed only one calendar per project. costs are prorated over the duration of a task, so you can't choose to front-load or back-load the costs. Also, the network or PERT diagram is still below par. Although it has been improved, its use of large boxes to indicate outline levels makes the chart visually complex. Finally, you shouldn't have to buy an additional package at \$195 to be able to plot your graphs.

In the final analysis, these imperfections are minor when compared with Time Line's fine, abundant features. With its ease of use and flexibility, it is an excellent choice for both novice and experienced business planners.

Viewpoint

Project management programs generally fall into two categories: those used by business managers to track modest-sized projects and those designed for professional planners involved in long-term, complex jobs.

As expected, the complex programs that handle large numbers of tasks command higher prices. They're often difficult to use, since many are based on minicomputer and mainframe applications.

Viewpoint 3.0 doesn't fit this mold. True, Viewpoint 3.0 doesn't fit this mold. True, Viewpoint costs \$1,995 and can manage 30,000 tasks; however, this easy-to-use program is surrounded by an unusual (at least for programs in this price range) menu-driven interface that makes the power accessible even to novice users.

While Viewpoint's human engineering is noteworthy, it is also distinguished by well-designed and well-integrated resource management, scheduling, and reports.

The program's base module won't wow you with fancy screens -- most displays are text oriented -- but they're truly useful. For example, the Planning Screen is the PERT chart equivalent of an electronic spreadsheet: Columns represent the time line, and rows are used to place activities according to different project phases or levels of detail.

The time scale is adjustable from a week to about seven years. This fact alone indicated Viewpoint is not designed for lightweight projects.

Many other tools exist for managing complicated events. One is the Network Tree. It lets you structure a project by first placing major tasks on the Planning Screen. Then you select one of the major activities and fill out an activity form that appears requesting information such as name, duration, etc.

A specific task in one subproject can be linked to a task in another phase. This gives you great flexibility in constructing projects; in less-sophisticated programs, once a subproject is inserted into a master plan, often only summary information is available from the subplan.

To accomplish all this project hopping and linking, as well as most other tasks, a mouse is recommended. That's because the display is thoughtfully arranged with several status areas, and by clicking on a certain indicator, such as Plan, Viewpoint toggles to an alternate mode. In this particular case Track appears, letting you update the schedule with actual dates or budget figures.

Selecting an activity exposes several data entry options. The main form captures basic data such as duration and a work breakdown code. The border of this form lists subforms, including resources; unlimited numbers of people, groups, or pieces of equipment can be added to each task from a list created separately.

Task connections are start-to-start, finish-to-start, and finish-to-finish -- with any amount of lag time. Seeing the project's logic as you proceed helps eliminate loops and tasks that end abruptly. But you need to position activities on the screen carefully to avoid unnecessary crossed lines. In a large project though, complex networks are the norm. So to help you through the maze a Trace command highlights work flow.

A Gantt time line is available -- plus histograms of resources and expenses. Histograms are particularly interesting -- by drawing a leveling line on top of the histogram bars, you can constrain costs or the amount of time people work.

Tabular reports of just about any aspect of the project are available, including earned value, monthly expenses, and schedule dates. If the built-in library isn't adequate, a custom report generator should help you fill in any gaps.

One shortcoming with Version 3.0 is the lack of import/export capability. Viewpoint 3.1 (soon to be released) offers compatibility with ASCII, Dbase, and Lotus files.

An optional \$995 graphics module (not reviewed here) generates the Gantt Chart, PERT Chart, Work Tree, and Network Chart on dot matrix and laser printers as well as color pen plotters.

On a EGA monitor, the highest resolution Viewpoint supports (Version 3.1 will support VGA), scrolling is immediate and smooth. You can quickly pan a large area of the network (the EGA 43-line mode is supported) to add a new activity or connections.

A benchmark project of 240 tasks initially required about 90 minutes to enter. That includes time to record the resource pool and calendars, plus several report and graph formats. They're saved in a library and can be used later in other projects. The Find option automatically locates a particular task within one second, even in a complex schedule.

Placing activities on the Planning Screen directly can sometimes turn into a disadvantage, however. After a recalculation, events between the top and lower levels may not lineup. Perhaps, for example, a department code was entered the wrong subplan. In this case you can switch to a tabular form to check for inconsistencies -- then perform a recalculation.

In general, however, Viewpoint's point-and-click interface is much superior to the command-line options or data entry tables prevalent in professional project management programs.

You go directly to the data entry form or optional menu in one step. And where several forms are required -- for adding resources or updating the base plan -- they're conveniently grouped together. We rate features and flexibility very good.

There's a fundamental difference between low-cost programs -- they hold all data in RAM -- and large capacity programs that spill project data onto a disk during calculations. A 12,000-task Viewpoint project, for instance, requires over 4 megabytes to store basic project data -- and an equal amount of space for intermediate swap files. It's recommended that subplans be limited to less than 100 activities, no matter what size the master project reaches.

Agenda 1.0

Agenda is probably the most general-purpose of all of these products and is definitely the most innovative in terms of design. It can be used to simply keep track of notes to yourself, or to help manage complex collections of text-based data. Agenda borrows features from outliners, database programs, word processors, spreadsheets, and even programming languages.

Agenda consists of four basic elements: items, categories, notes, and views. Items are free-form text strings (up to 350 characters) that can consist of just about anything: projects, tasks, phone calls, appointments, descriptions, random notes. Each item can be assigned to one or more categories and you can make up new categories as you go. This multiple assignment feature is the basis for Agenda's powerful cross-referencing capability.

There are some predefined date-related categories such as When Date and Entry Date, but you will normally define your own categories for each application. Categories can be structured hierarchically, such as people within a department, and departments within a division. Any item or category can also have a note attached to it, up to 10K in length.

Using techniques that approach artificial intelligence, Agenda can automatically assign an item to categories based on the item's (or its note's) contents. you can even provide multiple name for a category entry, to relax the matching requirements. Furthermore, an item with a date appearing in it will have that date assigned as its When Date, if you wish. Agenda also provides a comprehensive system that lets you define assignment conditions based on assignments to other categories and various date conditions. Agenda is capable of dealing with text information in ways no other product can match; we rate Agenda's item handling excellent.

Agenda has no calendar or scheduling features per se, but you can keep track of your schedule with judicious use of some of Agenda's built-in capabilities. to set up a time-based appointments calendar, for example, you would have to define a time category, with entries for the various hours of the day or days of the week.

The advantage to doing your appointment scheduling in Agenda is that each entry can also be cross-referenced by other entries. For example, you can set up a view to list all appointments with clients -- regardless of the day or time of the appointments -- or view them by project, by day or week of meeting, by due date, or by any other category you can dream up. However, you have to set up the view you want: It isn't built in.

The disadvantage to using Agenda for appointment scheduling is its lack of normal scheduling accoutrements, such as alarms and warning of overlapping times. You can view your entries by day, week, month, or even hour, but it is awkward to set up a detailed day-by-day calendar, and Agenda offers no specific calendar display or hourly-appointments view. You can easily create a view of today's tasks, but Agenda is not designed to fill the needs of detailed stand-alone time management, and if this is your primary need you should look elsewhere. Consequently, we view Agenda's calendar/scheduling functions as poor.

Most data retrieval is through Agenda's views. A view is an arrangement of a group of items by one or more category, providing multiple perspectives from which to look at your items. If you want items cross-referenced by additional categories, you can add category columns to the view. For example, having created a view showing your Urgent items, you can add a column that shows the When Date for each item, then add another column that shows the Topic or Person Responsible, and sort by any one of these columns. You can

then create a new view that switches this around, viewing the Urgent items grouped in subcategories by Person Responsible, with additional columns showing the When Date. You can define as many views as you need and instantly switch among them. For each view, you can specify filters that determine which items within each category will appear -- for example, filtering out any Done items.

Grandview 1.0

Symantec uses an outliner as the basis for Grandview, but the product is certainly much more than a high-powered outliner. It also offers several methods of categorizing and retrieving information contained in your outlines -- as well as a competent word processor.

Grandview's outliner is about all anyone would ever need in an outliner. It's useful for organizing and structuring a wide variety of information, including projects, organizational structures, reports, to-do lists, and names and addresses. Grandview is not RAM-resident, but it allows you to work with up to nine outlines (of any size) simultaneously, in separate windows. You have full control over window sizes and shapes and can also adjust the colors.

Grandview provides three views of your data: the outline, the word processor, and the category view. The category view is responsible for much of Grandview's power, since you can assign outline elements to various categories. Two categories are provided (Date and Priority), and you can augment the category list with as many others as you need.

Grandview's "items" are entries in an outline. Each can be assigned to one or more categories, which you define. A single keystroke brings up the full-screen category view, which consists of three windows. The category names appear in the first window. When you select a category from this list, the category entries are shown in the second window. The third window shows all the headlines associated with the entry.

As an example of how this might work, consider a Grandview outline set up to manage projects. Each headline in the outline might be a project. you might have a category called Person Responsible, and the assignments for this category would consist of the names of your staff. In the category view, you move the cursor to the Person Responsible category to get a list of all the people you've assigned projects to and then move to a particular person. Grandview will show you all projects for which that person is responsible.

Grandview can also make category assignments automatically, based on the contents of your headline. For example, you can set up an auto-assign rule that would give a headline an urgent priority if the word "today" is typed in. You can set up as many rules as you need. While this feature is nowhere near as powerful as Agenda's automatic assignments, it is quite useful and certainly easy to learn.

You can also send headlines to other sections of your outline (though not to other outlines). For example, you might have a heading called "Completed Tasks" and send other headlines there when tasks are completed. You can mark a group of headlines (not necessarily contiguous) and move, copy, or "clone" them. Cloning headlines makes a dynamic copy that will also change if you change the original. Overall, Grandview's item handling easily rates a very good score.

Grandview doesn't support calendaring and scheduling per se, but -- like Agenda -- you can accomplish some of these functions using tools built into the program. In Grandview you can define a category called Time, which could consist of times for your appointments. Combined with the Date category, you would have a rudimentary appointment calendar, but without the more fancy features such as alarms and graphic displays of time commitments. calendar functions are not a particularly strong aspect of Grandview and earn a poor score.

The category view lets you retrieve data in an outline by the category or categories to which you assigned headlines. Besides locating information systematically with the category view, you can also locate textual information with the search feature. This works across an entire outline, even collapsed headlines or text that is not visible.

Perhaps the most serious limitation is Grandview's incapability to cross-tabulate categories. For example, if you have categories for date and priority, you cannot easily display all urgent priority items for a specific date. The best you can do is display all items for a specific date and then look at the priorities. Agenda, on the other hand, could handle this with ease.

Info-XL 1.0

Info-XL is a general-purpose information manager that lets you work with free-form text and structured information simultaneously in a single information base. The composition of your information base is entirely up to you, although its structure takes the form of an outline.

Info-XL's items are outline entries, but each outline entry can have a lengthy comment, a set of fields defined as a record, and a date and time. These components provide, in essence, an almost unlimited depository for a variety of information.

With Info-XL, there are several different views into your data, which are contained in separate windows. The manager view is the primary view around which you organize your information. It's essentially an outliner with collapsible and expandable levels so you can limit your scope of reference, if desired. Any item in the outline can also have a structured record associated with it, and you can define as many record types as you need. The records view is used for more structured information such as would be contained in a traditional database manager.

Outline items in the manager view can also have comments associated with them in the form of free-form text. Comments for each headline can be up to 10,000 characters. Another view is the monthly calendar view. This shows a visual calendar, with highlights for the days that have items associated with them. These items appear in full detail in the daily schedule view, which is in yet another window.

You can have all of these windows visible at once, or zoom in for a full-screen view. As you scroll through the items on the manager view, a feature called "active viewing" shows you all associated data in the other windows. Info-XL's design makes it extremely versatile in terms of the types of information it can handle. We give it a very good core for item handling.

Although the product has separate windows devoted to calendars and a daily schedule, this is definitely a weak area for Info-XL. For any item in an outline, you can assign a date and a time. In the calendar view, you can move the cursor through a calendar and instantly see in a separate window the outline entry (as well as its parents) and the time associate with it.

That's about the extent of this product's scheduling. It doesn't warn you if time overlap, nor is there any type of alarm function. Another problem is that it is sometimes difficult to work with two views at once. For example, if you are trying to schedule a meeting on a particular day, when you return to the manager view the daily schedule view reverts to the current day so you can't see future appointments.

Dates must be entered explicitly using a Ctrl-D command. You must enter the date manually, and you cannot use the handy calendar that's sitting idle on your screen to pick off a date. In addition, the program will not recognize dates entered in the record view -- a serious omission that should at least be allowable as an option. While moderately functional, Info-XL's calendar and scheduling are not a particularly strong point of the product. We therefore give it a poor rating.

The product is designed such that moving through the outline will automatically reveal all relevant information in the other windows, including the record view (for structured information) and the comments view (for notes and free-form text). this is quite handy for browsing through your data.

The other method of data retrieval in Info-XL is through its "search" view. this incorporates an approximate search method developed by Proximity Technology. You can specify the degree of exactness you require: specific, general, loose, or open. It's handy when searching for words you don't know how to spell or for a group of related concepts. For example, specifying "worker" will pick up on items that include words such as work, workshop, working, etc. The results of the search are prioritized, with closer matches appearing at the top of the list.

Unfortunately, there is no way to specify an exact match, since we found that the specific match level sometimes fails to locate information that is there. This could be a serious problem if you need to locate a specific piece of information and the program cannot find it for you. The problems we noted with the search view are serious enough to drop Info-XL's data retrieval performance score to poor.

Info-XL's reporting consists of printing your outline and (optionally) the associated records and notes. You're fairly limited in terms of formatting, but you can print to disk and modify the report with your word processor. You can include only selected outline levels, and you have control over the numbering of each level when printed. Unfortunately, you cannot print to screen to preview your output. On balance, Info-XL's reporting is satisfactory for most purposes.

Primetime Personal 1.23

Primetime Personal is an easy-to-use personal scheduler and time manager. It can be run, optionally, as a memory-resident program and uses about 120K.

Primetime breaks down time management into three basic components: appointments, tasks, and delegated assignments. Once your information is entered into the proper module, the product's review and reporting capabilities let you view and manipulate your data. Its calendar function further serves to tie the information together and provides monitoring and alarm reminders.

Primetime's "items" are structured descriptions of appointments, tasks, or people. When tasks are entered you can assign due dates as well as priorities and classifications. When assignments are completed they appear on screen with a line through them and you can later purge them, if desired.

Primetime does a good job of juggling the different categories and keeping them organized. A nice feature lets you copy tasks to appointments and vice versa. For example, if an appointment is cancelled without being rescheduled, you can move it to the task module where it remains until you take some action. Overall, Primetime provides a wide variety of ways to manipulate your data, and we rate item handling very good.

Scheduling is clearly Primetime's forte. It's very flexible and setting up single appointments or even recurring appointments or tasks using the program's well-designed input screens is a snap. This lets you preschedule by day of the weeks, etc. (The structure of all input screens, including the contact list screen, is fixed, however, fields cannot be added or altered.)

You get a daily schedule of appointments or tasks (a to-do list), and can quickly scroll through days using the calendar as a pointer. There is no facility to give you a week at a glance, as is provided with Who-What-When. You can, however, print out future events for any time period you need. Leaving few features to be desired, we give Primetime a very good score for calendaring and scheduling. (An announced network version of Primetime will add week-at-a-glance capabilities, the vendor says.)

It's easy to access information in Primetime. A menu system is used to move between modules, called Appointments, Tasks, Assignments, and Phone/People. Alternatively, you can use Alt key combinations to jump between these modules. A clever on-screen calendar serves a variety of purposes. You can use it to pick off dates when you need to enter a date. You can also go into Calendar mode, move through the calendar and watch the window show

various appointments or tasks assigned to each day. Data retrieval is good.

Primetime has a dozen predefined reports, which can be sent to a printer, a file, or to the screen. You can select one or more of the reports and have them generated automatically. the reports are nicely formatted, but you have no control over how they look. The only thing you control is the start and end dates for each report. Even so, if you select a group of reports, they must all be for the same time period. What they lack in flexibility, they make up for in content; we rate Primetime's reporting satisfactory.

Tickler/2

Tickler/2 is the electronic equivalent of those famous paper-based tickler files that many disgustingly organized people use. A classic tickler file takes up loads of space by using individual file folders, one for each day in the month, along with folders for individual months and upcoming years. You fill these folders with pieces of paper: notes, reminders, letters to follow up, and so on. It can get absurdly crowded and confusing, and you're up the creek if misfile an important paper.

This program uses OS/2's extended memory capacity and multitasking abilities to offer a huge amount of options. Besides the normal chore of entering appointments, you can set messages to appear on your screen at just about any interval or on any date, even years in advance. It also has a relative scheduling feature that lets you enter a major event and then indicate when and how often you want to be reminded of it. If you tell it to be merciless, Tickler/2's "nag" feature will continually remind you of something you need to get done until you indicate you've done it. It will also count down the days (or hours) until deadline. Features like this are just the thing for foot-dragging editors who put off writing Short Takes until the last minute.

Tickler/2 also lets you attach OS/2 commands to a message. With this feature, you can have Tickler/2 do things like automatically sending a monthly report to the boss or performing a weekly hard disk backup. I used it to automatically log on to BIX overnight, get my electronic mail, and file conference messages. Sure, you can do this with several MS-DOS programs, but the fact that it's integrated with Tickler/2's other features makes it handy indeed.

But the most intriguing feature is something that is called a "named event." You can attach a virtually unlimited list of messages to an event that you can't pin down to one particular time. For example, if you sell computers, you can enter messages that are set to start every time a customer buys a system, doing things like sending a thank-you letter, service reminders, and even a "trade-in time" reminder a few years in the future.

ActionTracker

Information Research Corp. characterizes ActionTracker, its \$198 task management program, as "multiproject control made simple." That description falls close to the mark. Designed more for following and integrating activities related to many small projects than for single huge ventures, the program creates a flexible database of events that can be accessed, viewed, and analyzed in a variety of ways.

You don't have to be an expert project manager to use ActionTracker. In fact, in deadline/appointment orientation makes it better suited to managers and professionals than to those schooled in project management methodology.

The best way to get acquainted with ActionTracker is to install its sample data and follow the tutorials. After working with the sample data for a short amount of time, you'll find the instructions in ActionTracker's manual

more meaningful.

ActionTracker's screens don't throw you any curveballs. Options are displayed on menu bars at the bottom of the screen or in windows that pop up as needed. Function keys control most actions and are used consistently throughout the program. Should you get lost, context-sensitive help is always available.

The program offers other timesaving features. An Enter Previous option pops in the value previously typed into the same field. Templates are available for entering often-used actions, as are reminders fields that automatically insert up to four copies of an action into appropriate daily calendars. A beep and a message warn you that you may have mistakenly placed reminders on weekends and holidays, but you can still assign reminders to those days if you need them.

ActionTracker's flexible entry options allow you to tailor the system to your own work habits. For example, you may prefer to create a list of steps in a project and assign dates or personnel to them later. You may budget time or money or both. You may create miscellaneous actions that remain unassigned indefinitely. You may change dates through either action lists or calendars. Experienced users can customize screen colors or trade a degree of data security for faster file updates. In fact, not only does the program not try to force your application to bend under its rule, but ActionTracker's documentation strongly encourages you to reinterpret the program's basic structures.

ActionTracker puts information into five data files called projects, projects sources, actions, types, and resources. These terms can be defined broadly. For example, in an application for professional groups, the sources might be the clients and the projects might be the individual assignments. In an application for portfolio managers, the sources might be categories of investments and the projects might be individual instruments. Each project may have up to 100 actions, but there is no limit to the number of projects, sources resources, or types that the program can handle. In addition, the program lets you cross-reference files, allowing a wide variety of data views.

Also adding to the program's flexibility are 14 built-in reports, which include action lists across project lines categorized by type, source, department manager, or responsible person. You can vary the selection criteria for these reports by using ActionTracker's filter options. For example, you might create a report with or without budget summaries, including or excluding completed items, and focusing on a particular time frame.

askSam

AskSam, a powerful and fast text-based database, is a power user's personal information manager. As such, the \$295 program requires that you spend a good deal of time learning how to use it. But the payback for that investment of time is great because you can use askSAM as a very sophisticated personal data-handling tool or an application development system.

askSam is equally happy with structured and unstructured data, making it an appropriate tool for handling corporate as well as personal information. The program affords you total control over the type and form of data you enter as well as many ways to search and report from that data. While the program has neither the preset categories and views of Lotus Agenda nor the built-in outline format of GrandView--nor, for that matter, the detached but precise method of presenting files for perusal that ZyIndex has, it does give you the flexibility to create any of those setups.

Installing askSam is a breeze. Even though the program is loaded with features, it comes on just two 360K disks and requires only 256K of RAM and one floppy disk drive. askSam's SETUP program is used to specify system defaults. The menu for setting system defaults is deceptively simple for the level of control it gives you. Besides the usual choices of screen color and report margins, askSam lets you specify such fancier options as dialing sequences for its phone dialer and the translation table that determines the order of ASCII characters when sorting files.

Once installed, askSam is run by a series of menus. You make choices either by moving the cursor and tapping the Enter key or by pressing a single letter key. Both context-sensitive help screens and a help menu are at your disposal. The help file is a regular editable askSam file. The manual includes nine tutorial lessons, a reference section, and an index.

AskSam stores information in records and documents, both of which can be kept in the same file. A record can be only 20 lines long, but a document has no size limitation. A document can also hold a number of records. You don't need to worry about record or file structure beforehand or ever, unless you want to.

There are no constraints on how you enter data; you don't even need to do it the same way in different records in the same file. You can, for example, use a unique character, such as an asterisk (*), to mark the beginning of a special field, then switch to field names followed by a left bracket ([). Alternatively, a pair of brackets can indicate where and how long a field has to be.

askSam also allows you to type or import free-form text. You can set up entry templates (as many as ten per file) that can be activated by function keys. To save data entry time, you can create overlays of often-used information. And you can mix structured and unstructured data in individual records.

Once data has been entered, askSam offers myriad ways to search for information. You can search for all or part of any word or combination of characters including using the DOS wildcard characters ? and *. The simple function \$: lists, totals, counts, and displays the average of all numeric entries in a file that follow a dollar sign.

DayFlo Tracker

If ever a program deserved to be called a personal information manager, DayFlo Tracker, from DayFlo Software Corp., is it. By pairing field-based forms with free form text entry, the \$149.95 program offers a blend of structure and flexibility that is hard to beat. Whether you want to build an annotated mailing list, maintain a database of correspondence, or keep notes on phone conversations, DayFlo Tracker can do the job.

DayFlo Tracker consists of the program itself, a version of SmartKey (a keyboard macro program) that will work only with Tracker, and an application pack. As shipped, the package includes two predefined SmartKey macros--for time and date. Either of these can enter the appropriate value into a record with a single keystroke. DayFlo does not include a SmartKey manual with the package but will supply one for a \$10 handling fee. A though Tracker requires only 384K RAM, it needs about 1MB of disk space and at least 100K for your data files. (DayFlo also sells a laptop version--Tracker-720--intended for computers with two 720K disks drives.)

At first glance, Tracker behaves like a garden-variety flat-file manager. The program lets you create fields and designate them as alphanumeric, numeric, date, or yes/no; choose fields to index; and retrieve records based on field content.

But once you get past this bare-bones description, Tracker sets its own rules. To begin with, fields have no predefined length. You can type text in any field up to the maximum allowable by the program--32,000 characters per record. YOU can even type text in nontext fields. Tracker will beep and ask for confirmation before accepting the text, but the program will not stop you from entering it.

A second notable difference is that Tracker can handle multiple values in each field. For example, you can enter as many keys in a keyword field as you like. The individual values are separated by a special end-of-value marker.

Surely the most interesting feature of Tracker--and the one that takes it beyond flat-file database management--is its ability to mix data forms in a file. This gives Tracker some of the features of multifile database management system.

For example, to construct a database of sales leads in a flat-file manager, you would have to create one large form with fields for name, address, phone number, product category, credit rating, income level, referred by, and so on. If you were using a multifile DBMS, you might break this information into three files--one forename and address, one for product category, and one for credit rating. Records in the three files would be tied together by a shared field, such as referred by. With Tracker, you can do the same thing by creating three forms that share at least one field.

So if you can achieve the same results using a multifile DBMS as you can with Tracker, why not go with the DBMS? Simple. Tracker's ability to handle text gives you the freedom to write extensive notes about, say, each of your sales leads, making it more a notebook-like tool than a repository for unannotated information.

Tracker's multiform feature lets you store memos, letters, random notes, items for a to-do list, notes for tracking projects, and more. If you include a few well-considered fields on all forms--such as action date, project, and keyword--you can then retrieve records in ways that cut across data-form type, such as all actions to be taken today or all phone conversations, letters, memos, and status notes related to a given project. The maximum capacity of 65,000 records goes well beyond any likely need.

GrandView

Since outlines are held in memory while you're working with them, they can be only as large as the conventional memory available on your computer. An outline entry, called a headline, can be up to 64K in size. You can attach any type of text to a headline in a form called a document, which is also limited to 64K. You can use documents to add free-form information about a headline or even to contain letters, memos, and other word processing functions.

It's easy to position headlines using the cursor and control keys. Whether you move a headline higher or lower or make it dominant or subordinate to the headline preceding it GrandView automatically rennumbers the outline.

GrandView expands or collapses headlines at your command, in effect letting you zoom in or out of specific parts of the outline. The program uses a clipboard to move text around an outline; you can also copy or move headlines from one section to another. A headline-cloning feature lets you keep the same information in several places within an outline without having to worry about updating each occurrence: when you change one clone, the rest change too.

GrandView uses categories to filter or shuffle headlines, allowing you to look at them in different ways. For example, a to-do list might have categories for Type of Activity, Who Else Is Involved, and Supplies Needed. Date and priority categories are included with all outlines, but you can add whatever other categories you wish, such as Person Responsible, Type of Business, or Contact, as long as you don't exceed 20 in all.

Also important is the concept of assignments, or short definitions that summarize the content of important headlines. After you set up categories for your outline, you must assign these definitions to one or more categories. You can then view your outline by assignments.

You have the choice of typing each category assignment or letting GrandView do it for you by matching your keystrokes with existing entries. Or you can set up automatic category assignments (for instance, assigning Bob to the Person category for every headline that contains the word training). I found this last feature easier to use than a similar one in Agenda, but not as robust.

The Category View of a GrandView file is a powerful filtering agent. It is the view that you will probably use most often, since it lets you look at headlines from many different perspectives. In Category View, the top-left corner of the screen shows the categories you've set up for an outline, and

the top right shows the assignments you've made for a category that you've highlighted. The lower part of the screen shows the headlines that match the category and assignment combination displayed in the top two screen sections.

To be sure, that's not GrandView's only impressive feature. The program lets you open up to nine outlines at a time. If you want multiple outlines to appear on-screen at the same time, you can view them as tiles or in folders or have them overlap--enough choices to satisfy most anyone.

You can time- and date-stamp headlines, create templates, and name headlines for reference when copying or moving them (which resembles naming spreadsheet range). Headline-labeling styles exist for numbers, letters, symbols, bullets, and connecting lines. In addition, you can use the program's macro language with learn mode to create, save, and play back entries or command sequences, and you can reconfigure the keyboard to suit your preferences, changing command-key assignments.

The Idea Generator

Experience In Software was founded with a single goal in mind: to come up with software adaptations of techniques presented in Gerard I. Nierenberg's popular self-help books on negotiating and problem solving. The Idea Generator, the company's second product, is inspired by the book *The Art of Creative Thinking*, which is included with the \$195 package.

As its name implies, the Idea Generator is designed as a catalyst for producing ideas on how a specified problem could be solved. It works primarily by helping you ask the problem in different lights in an effort to get the creative juices flowing. It really has no application beyond this quite limited purpose.

Info-XL

By offering formal and informal data formats along with outlining, monthly calendar, a daily scheduler, and six interrelated windows, Valor Software Corp.'s Info-XL gives you a multifaceted view of information. The \$295 program lets you search through several of these windows at once and cross-reference data, tying together different kinds of information in every way that counts.

Info-XL's main organizing window is called Manager. It might just as well have been called Skeleton, because it holds your information in outline form. Every entry is considered a heading; each can be indented to create sublevels as deep as you want. Levels can be collapsed or expanded to control the amount of detail you see.

For every entry in the Manager window, you can have a Record and a Comment, each in its own window. The Records window is database-like, requiring that you enter information in fields. Info-XL offers you five record types, but you can add or delete fields in these records or create as many new record types as you like.

The Comments window is where you enter free-form information up to 10K in length. It's here that you also find such basic word-processing functions as find and replace. You might want to use it for entering notes about people or companies, a history of telephone conversations, meeting minutes, research memoranda, reminders, article summaries. Text entered in the Comments window can also be cut and pasted into the Records window.

In this initial version of the program, the Comments window is also the place where you import ASCII, WordStar, and other word processor files. The importing features is somewhat crude, requiring you to do a lot of cutting and pasting as well as keying heading into the Manager window. But you can record a keyboard macro to make this procedure somewhat more palatable. Of course, you can use the macro feature to record and recall other repetitive operations or strings of text as well.

According to Valor Software, the program's importing facilities will be improved in Version 1.1, which is due out by the end of the first quarter of 1989. The revision will allow you to send data directly into the Manager and Records windows, and will also let you import comma-delimited ASCII and dBASE files. Version 1.1 will have on-line help, new documentation, and a phone dialer.

A Daily Schedule window shows you the headings you have dated and time-stamped in the Manager window. You also get to see the higher-level heading under which an entry falls. A speed-key combination of Ctrl-G lets you jump from a highlighted item directly to the corresponding heading in the Manager window.

The Monthly Calendar window, which is linked directly to the Daily Schedule window, presents a month's worth of information and highlights dates to which activities have been assigned. Placing the cursor on a day with activities displays them in a Daily Schedule window. The link between the Daily Schedule and Monthly Calendar windows makes it easier for you do such things as plan and review projects and maintain to-do lists.

Because different pieces of related information are linked through Manager headings, they become visible at once. An event heading located in Manager could be linked to relevant information in Records, Comments, and Daily Schedule windows.

Besides showing information that is directly related, Info-XL lets you move quickly to more distantly connected data by scrolling to different levels of headings in the Manager window. For example, you might go from the listing of a customer to the listing of a competitor, and then to a particular product of that competitor, and then to a particular product of that competitor--with a list of product of that competitor--with a list of product specifications in Records and several competitive sales approaches in Comments. Best of all, you never have to open and close different database files to do all this. You can even connect sections of the Manager by putting the same heading in a number of places and marking them as linked. Then you can jump from one linked entry to the next.

MemoryMate

Technically, MemoryMate is a memory-resident, free-form text database. You create records by typing text, importing an ASCII file, or grabbing text from an application screen. Records can be up to 120 lines (of 80 characters each long, and there can be more than 32,000 records in each database file. You can create as many separate files as you want. Since it's memory resident, your text database is available at any time, from within whatever foreground application you are running when you hotkey into MemoryMate.

Actually, MemoryMate can run as a stand alone application, but that deprives it of one of its main virtues--constant availability. Other PIMs, like Lotus's Agenda and Symantec's GrandView, aren't memory resident, so they demand that you drop whatever you are doing in order to use them. Persoft's IZE can be used in memory-resident mode, but it eats a whopping 300K RAM, compared with MemoryMate's relatively dainty 88K RAM appetite. Under LIM 4.0 it can occupy as little as 30K of DOS memory.

When you hotkey into MemoryMate, you are presented with an uncluttered, two-part screen. The top of the screen is a constantly visible menu bar; tapping Esc activates the menu. To execute a command, you either point and shoot or you tap Ctrl and the first letter of the menu item.

The rest of the screen is a blank area where you can type whatever you want: phone numbers, a letter, or an outline of this afternoon's speech. When you finish, you save the record by selecting MemoryMate's Save command, and the program gives you a blank screen so that you can start another record.

Each time you save a record, Memory Mate prompts you for a "reminder date" in mm-dd-yy format. When you hotkey into the program on a particular date, any records that have a matching reminder date automatically pop up. In this totally painless way, MemoryMate builds a tickler file. You don't have to specify a date for every record you enter, but this feature is invaluable for remembering appointments and due dates. And although the program could hardly be considered a project manager, you can construct a series of notes that remind you of where you should be in a project on a given date. Each note will pop up in sequence as you move through the subtasks of the project.

MemoryMate's search capabilities most clearly reveal its power. The program automatically indexes each word in a record. You use the Find command to search for a record by specifying any text string in the record, or by entering the date created or the reminder date. All records that contain the string or match the date pop up, and a status indicator in the upper right of the screen tells how many records have been found. You can step through these records by tapping the Plus or Minus keys on the numeric keypad, or use the Jump command to go directly to a specific record. If your search is too broad and finds more records than you want to pick through, the Narrow command initiates a more specific search of records already found.

Date searches are particularly useful, since you can immediately call up the records that pertain to a certain date. You can also use mathematical operators (=, <, >, and so on) to find all of the records created before or after a specific date. One irritating limitation, however, is that the program lacks a simple way to pop up all of your records at once so you can browse through them. The only way to do this is to request all records created after an arbitrarily early date, like 1/1/11.

PackRat

If Windows has a failing, it's that Microsoft built in too many free utilities and applications. For example, if you need to jot down appointments, reminders, to-do lists, or random notes to yourself, there's a way to do it in Windows, primitive as that method might be. It is Polaris Software's hope that PackRat, its \$395 personal information manager, will entice you to forgo Windows' rudimentary procedures for a new set of better-integrated, more-sophisticated tools.

The Microsoft Windows installation software is among the simplest to use. And Microsoft allows software vendors like Polaris to use it as the installation procedure for their own Windows applications. If you know where you want to install the software, whether you'll be using a mouse, what printer you have and how it's connected, and what video display system you're using, then you can install PackRat in as little time as it takes for the installation program to copy the files to your hard disk.

If you're not already using Windows, don't assume you'll have to discount PackRat: Polaris supplies a Windows/286 runtime module that will encase its software in a Windows shell. (On machines slower than the typical 8-MHz 286, you'll find that PackRat and Windows run in what seems like slow motion.) I installed the package under Windows 2.0 and Windows/386 without incident.

Windows itself comes with a clock, a calendar, a notepad, and an index card file. Unless you do some manual labor, these utilities are disjointed, working independently of one another. PackRat brings these features and more into a cohesive group of seven "facilities" that are interrelated (and, at times, interdependent) text and graphic data-bases. Originally two separate programs but now united under Windows, PackRat takes care of phone book and phone log chores, agenda and task tracking, expense logging, index card filing, and the onerous duty of cataloging disk files.

With no real phone-logging system, I have spent the better part of the last 2 years entering names, addresses, and phone numbers in a Windows card file. It will hook to an auto-dialer, and with Windows' notepad beside me I could jot down notes as the need arose. With PackRat I just click the name of the person whose number I want to dial; PackRat does the dialing through my dialer, starts a time log, and leaves me a broad expanse of white space in which I can do all of the doodling I want. The only drawback is that PackRat cannot import my Windows files directly because it knows ASCII and Windows does not.

PackRat's phone log system is a consultant's dream come true. While the system won't calculate a fee based on the time you've spent on the phone, it does provide ample space for recording details of conversations as well as offering automatic date, time, and number stamping. Well, you can have almost everything.

PackRat's index card system is phenomenal in its class, combining the better elements of a free-form keyword-searchable text database with those of a structured field-oriented data file. Up to 32,000 characters can be stored on any card. The card is then addressable by up to eight keywords if you use the default text database format, or by specifying the field search criteria based on the contents of up to eight data fields that you've created using the Custom Labels option.

You can, optionally, apply your custom file labels to all of the index cards you'll be using or just to the individual card you're currently filling out. You can create a catalog of these custom labels and have several different field structures (or no field structures at all) included within one card file. When you've entered the field data or keywords (either of which is actually a list of possible recall parameters and not the true contents of the card), you then have a 32,000-character index card that you can fill with the data of your choice. It can be text or graphics; PackRat doesn't care.

I found PackRat's concept of agendas and tasks a bit bewildering at first because I assumed that a task would have a subordinate position to an agenda. PackRat, however, treats them as separate entities and places slightly more emphasis on time tracking for agendas than for tasks. you handle tasks in the same manner as you might organize a small-scale project-management time line--with attachments and dependencies that are assignable to people found in the phone book or to other tasks that must precede them. Agendas emphasize starting times, such as the time a meeting should begin, and may be assigned to people.

There are other small annoyances. PackRat's phone book limits you to using at most 30 characters for personal and company names, which isn't a major flaw--it's just irksome. In fact, the only unbearable portion of the entire program is the calendar display. While I am pleased to know the current day and date, and to know what chronological day of the year it is, I am troubled that there are, as of this writing, only 103 days left (until the end of the year, of course, but the program never tells you that). I can't help wondering what will happen when there are no days left at all. These minor points aside, PackRat is the personal information manager of choice for Windows users.

Primetime Personal

Primetime Software has chosen to concentrate on a limited area of information management and give it a solid treatment. The result is Primetime Personal, a time-management program that elevates the appointment calendar and to-do list to a fairly high level of sophistication. The \$99.95 program lets you do anything from jotting down a reminder or an appointment to scheduling start and due dates for a number of delegated assignments, all with a minimum of effort.

Primetime Personal relies on a standard database structure rather than the sort of free-form approach taken by programs such as Agenda. This means you have to call up the module in which you want to store information and enter it as a record by filing in the appropriate fields. Still, the program's intuitive design makes using it almost as easy as grabbing a pencil and a notepad.

The main menu and a calendar are always displayed in the top portion of your screen, while the screen of the module you're currently in occupies the rest. Speed keys switch you from one module to another readily, and a function-key menu at the bottom shows all the options available within each module.

An appointment module and a task module constitute the core of the program. When you call up the appointment screen, you're presented with a facsimile of a page from an appointment book showing your schedule for the current date with the current time slot highlighted. An N to the right of an entry means there's a note attached to it, which you can read by hitting F4. The size of the time slots defaults to half an hour, but you can change this size to whatever you want. The program even accommodates appointment times that don't fall on a regular dividing unit (such as 3.37), and it lets you schedule concurrent or overlapping appointments.

An alarm reminds you of particularly important engagements; you can control both the duration of the alarm and the amount of lead time it gives you. This feature, of course, is practical only in Primetime Personal's memory-resident mode. But since the program consumes 120K of RAM as a TSR< you may think twice about making it a permanent resident in your PC's memory.

You can flip to other days by means of the calendar at the top of the screen--one of the program's nicest features. The cursor keys, plus PgUp and PgDn in conjunction with the Shift key, move a highlight from the current date to any other on the calendar. When you release the Shift key, you're presented with the schedule for the date you've selected. Shift-Home moves you back to today's date.

Calling up the task screen shows you today's to-do list. When you enter a new task, it normally appears immediately on your to-do list and stays there until you remove it. You can also enter forthcoming tasks to be automatically added to the list at a later date. If you specify a due date for a task, the to-do list will also show the number of days left until the deadline. The onscreen calendar facilitates dating an entry by automatically filling a field with the date you've highlighted on it. Another neat touch lets you enter date abbreviations such as "2w" for "2 weeks from now."

You can prioritize tasks and categorize them, but category labels can consist of only a single letter. Primetime Personal also lacks the ability that Agenda and GrandView have to categorize items automatically according to their content. On the to-do list, Primetime Personal can display tasks in order of priority, category, or due date. Although each item can be no more than 50 characters long, Primetime lets you attach five line notes to each item.

One of Primetime's strongest features is its automatic task- and appointment-generating facility. Suppose you want to schedule a meeting for 3 P.M. on the second Wednesday of every month or add a reminder to your to-do list to water your office plants every 4 days. You need make just a single entry, and the program will automatically add the remaining entries to your appointment schedule or to-do list as far into the future as you specify.

Another option gives you some elementary project management power. You can delegate tasks already on your to-do lists or assign new tasks to other people. Simply adding a person's initials to the assignment-code field of a task will mark it as an assignment. It will then not show up on your to-do list until the date you set for reviewing the assignment.

Pertmaster Ver. 6.0

Details a critical path system with many user reports. Lets users manage multi-activity projects using either the project evaluation and review technique (PERT) or critical path analysis method (CPA). It has a maximum project network size of 1,500 or 2,500 activities, accepts up to 29 different resources per activity and analyzes and updates a full network in less than 10 seconds. It allows the user to specify when each task must be finished, fixed costs as well as set holidays. The 'zoom' function allows a user to input, edit, or delete a plan link or activity while viewing the network on the screen. Particularly useful is the ability to easily enter resources, activity durations and descriptions while viewing the network and seeing the immediate results of such changes. Includes an edit-to-bar chart direct path and scroll-through menus. Users can jump from the edit through the 6 menu choices needed in the past.

PC-Path Ver. 1.1

This is a project scheduling program using critical path method. This package accepts up to 1000 activities per network and has a three year calendar option. The reports include edit, calendar, summary, milestone, schedule and bar charts.

Trac Line Maps

Management and planning program to help direct, control and monitor activities and details involved in completing project on time. Shows you the information that helps you decide how to use your resources most efficiently. Includes: PERT: Will ask you for your objectives in every precise terms. Will post all the road signs you need, comparing actual achievements to your estimates, noting your planned milestones, so you can see problems early, put your brakes on, and decide fast on the best, alternate route. Coordinating Projects: The engineering manager's Project is to develop the product, the manufacturing manager must produce it, the marketing manager needs to get it sold. Then there's the manager responsible for coordinating all three. Critical path Gantt charts: Use many modern analytical techniques such as PERT, Gantt charts, critical path and crashing in their analysis.

PROMIS - Project Management Integrated System

PROMIS provides project scheduling, resource management, budgeting, cost control and report-writing capabilities for project managers. PROMIS utilizes the critical path method to track a maximum of 800 activities. The program also provides password protection, data encryption and transaction logging to ensure data security. PROMIS is a powerful, network-based project management system designed to perform complete planning, resource management and cost control functions. Most every function of your PROMIS schedule is user-definable, from task-numbering and coding the daily work requirements. A versatile subnetwork system enables you to input and process virtually an unlimited number of tasks. Their costs and resources.

Microport 0

This project management system offers numerous graphic and report output options. Menu driven with on-line help facilities. Produces time-scaled network diagrams, Gantt charts on screen (no special graphics hardware required) or printer. Can print charts sideways on IBM or EPSON printers. Handles projects to 220 events, 200 activities. Define schedules in any time units. Charts and reports by department. Five sorting options. Facilities to enter, modify and rearrange project data. Multiple copies of charts and reports on request. Multi-directional scrolling through charts on screen. Programs and data can be stored on hard-disc.

Project Scheduler 5000

With this program you can precisely forecast, schedule, control and track large projects easily and quickly. Features include: critical path method using the Gantt chart to depict schedule. Calculates the critical path using the precedence method. Provides you with updated schedule information immediately after each add. Delete or change to project data. This enhances your ability to analyze the potential schedule alternatives thus giving you the opportunity to select the most viable and cost effective one. Project Time Scale and Calendar determines how the project schedule is plotted. The available options are Month, Week and Day. In addition, the Day Scale can be divided into shifts or hours.

Vue

Vue is an interactive project management system that is easy to use yet powerful enough for highly complex projects. Vue is an interactive project management system that uses the critical path method, spotlighting those activities whose timely completion is critical to finishing the project on schedule. Up to 3,000 activities can be tracked per project, with nearly unlimited activities available through the multi-project option. Vue is an easy-to-use menu-driven system with minimal training needed for entering project information and generating reports. A bar chart can be requested with daily, weekly, or monthly scaling. This makes it easy to overlay on a resource report to determine which activities might cause resource peaks or valleys. Also, a comparative bar chart report with baseline data is available

to compare original plans against current progress. Users can specify either I-J or precedence notation. Vue provides immediate turnaround of results as job progress is reported. The multi-project option enables planning and analysis of related projects than 14 standard reports and even design their own unique report formats.

Task Monitor

A project management program designed to automate project management functions. Includes: Schedule modeling - Analyze project schedules four different ways by using optimistic, pessimistic, most likely, and statistical values for the duration of each activity. This is an invaluable asset to help you plan, monitor, and control projects. Subnetworks - Structure your project into pieces to fit your management style, and let the program automatically collect and receive reports on project progress. Your project may have an unlimited number of activities, because of this powerful feature. Each activity contains a 20 character description field, a 200 character 'note pad' and three user definable (20 character) sortable fields. Actual to date, budgets and projected totals at completion are displayed in bar graph form for hours and dollars for each activity and for the entire project.

Quick-Plan

Facilitates the design and construction of business strategies, contract bids, resource allocations, budgets, schedules and more. It also includes long range plans of both a corporate and project nature. Most plans are too complex to hold in the mind's eye or to understand in one glance. Quick-Plan translates plans into screen graphics that can be expanded, moved, dissected and analyzed. Quick-Plan displays the relation of every activity to every other activity in the network. By zooming, spreading and isolating, the manager can literally 'paint' a picture of network logic. Quick-Plan helps managers build their plans with through specifications that are entered into the computer using a series of easy-to-follow menu screen. With its exclusive 'select-sort-report' feature, Quick-Plan acts as a data 'filer' that permits the manager to select out only that information pertinent to the issues at hand, and in a format of the manager's choosing. The reports can be viewed on the computer screen or printed in clear, well-structured report formats.

Value Index

Allows you to compute the value of one project or the relative values of many projects. Enter the criteria to be used for evaluating alternatives. Then enter the weight of each criteria. Enter the alternatives. Then enter a multiplier for each alternative-criteria combination. The program will compute the relative value of each alternative. The weighted total of each alternatives can be added. Changed, or deleted from a list. Criteria lists can be used with different set of alternatives. Value indices can be computed using different sets of criteria. Generate both criteria and alternative reports: alphabetically, by item number, by priority, or by computed weight.

Days & Oates

Program assists in planning work assignments, scheduling jobs, or defining milestones. Enter the month, day and year and the program computes the day of the week. Enter a base date and a target date and the program computes the lapsed time between the two dates. Enter the base date and a time span and the program computes the target date.

PathFinder

A project management program that arranges project tasks with as many as 500 activities per project. The program keeps track of each project, spotlights critical activities, singles out the costs of any phase of operation and changes specs or other variables and projects the new end results.

Gantt-Pack 'Work Processor'

A planning, scheduling, project tracking/control, and resource management tool with graphics, extremely easy to learn and use. Stores files that show tasks, assignments, personnel, costs and timetables. Excellent for multiple projects that share resources; also hierarchical projects. Critical milestone charts help spot/prevent potential bottlenecks. Saves multiple versions of plans. Changes, to reflect new conditions, are quick and easy. Search/sort shows status of projects from any perspective instantly. Flexible, versatile for any application. Exports ASCII files to spreadsheets, word processors, modems. European date conversion feature included.

Appendix VI

Implementation Plan

12/7/88

Implementation Plan

**Milestone Tracking System
SSFPO Integrated Schedule System**

**** 12/7/88 ****

prepared for

**Space Station Freedom Project Office
NASA Johnson Space Center**

prepared by

**Peter C. Bishop, Director
Space Business Research Center
University of Houston-Clear Lake**

December 1988

Objective:

The Integrated Scheduling System (ISS) is an information system which will assist managers in the NASA/JSC Space Station Freedom Project Office (SSPFO) to create, record, coordinate, and communicate schedules, meetings, and actions which are relevant to the Project Office and which require coordination between Division Offices.

The Milestone Tracking System (MTS) is the first component of ISS. MTS will record and communicate the major activities and associated milestones of the Project Office and the Division Offices.

Approach:

The Management Integration Office (MIO) will publish a packet of office-level schedules out to the next major Level II milestone. The packets will be distributed weekly to the Target Group (e.g., Project Office and Division Office staff; cf. Attachment #1). The packet will include:

- . the current Level II schedule
- . the current Project Office schedules
- . the current Division Office schedules.

Each schedule will be a one-page Gantt chart similar to Figure 1.

Implementation:

Following approval, MTS will be implemented in two phases. The first phase will initialize MTS. The second phase will operate it. The sequence of events will be:

Phase 0 -- Approval:

1. The ISS Working Group will review this implementation plan. If the Group approves of the plan in principle, they will be dismissed from further work on this project.
2. The Target Group will review the revised implementation plan. The revisions will be based on the final comments from the Working Group. The first phase of implementation will begin following Target Group approval.

Phase I -- Initialization:

3. Each Office Manager appoints a Schedule Representative (SR) who will be responsible for the preparation of schedule materials and coordinating those materials with MIO.
4. MIO and UHCL staffs meet with each SR to begin preparation of the Office schedule through PDR. Preparation of the schedule will include the following steps:
 - . familiarization with the Level II and III schedules
 - . identification of the major activities (ca. 10) for that Office in support of the Level II and III milestones
 - . identification of the start, end, and interim milestones for each activity
 - . presenting the schedule in the form of a Gantt chart (Software on order from McDonnell Douglas will be used to create the Gantt charts.)
5. The SR secures approval of the proposed schedule from the Office Manager and other staff.
6. The Office Manager (or SR) briefs the Target Group on that Office's approved schedule.
7. This phase is concluded when all Offices have completed Step #6.

Phase II -- Operation:

8. Late each week (Thursday afternoon), the SR from each Office sends a red-line copy of that Office's schedule to MIO. The SR may return the Office's schedule marked "No Change."
9. MIO updates each schedule, highlighting the areas that have changed since the last publication.
10. MIO distributes the updated schedules to the Target Group prior to the staff meeting (Monday morning).
11. The Target Group discusses those changes which it wishes.

12. MIO incorporates the changes submitted and discussed into a revised schedule and distributes that scheduled to each Office (Tuesday morning).

Resources:

Hardware capable of running the MDAC scheduling package.

Professional personnel in MIO to supervise initialization and operation.

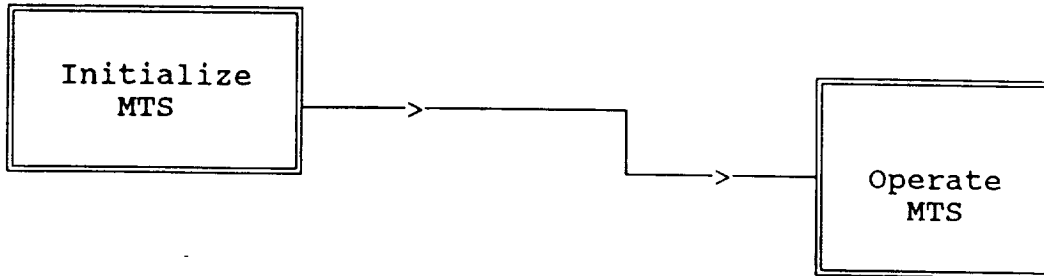
UHCL/RICIS support to help initialize and monitor operations.

Contractor support to create and distribute the schedules.

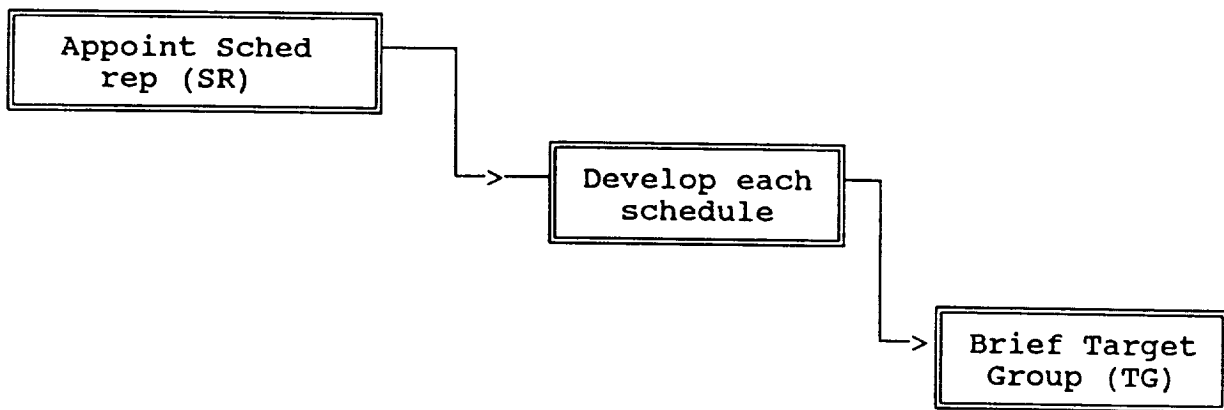
Space Station Freedom Project Office
Integrated Schedule System

Flow Charts

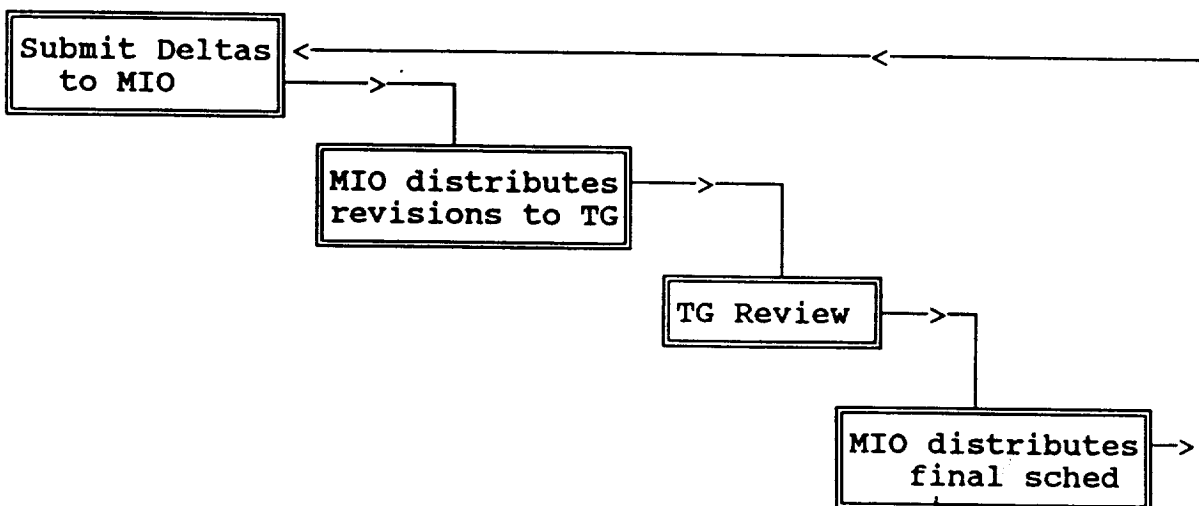
Level I -- Milestone Tracking System (MTS)



Level 1I -- Initialize MTS

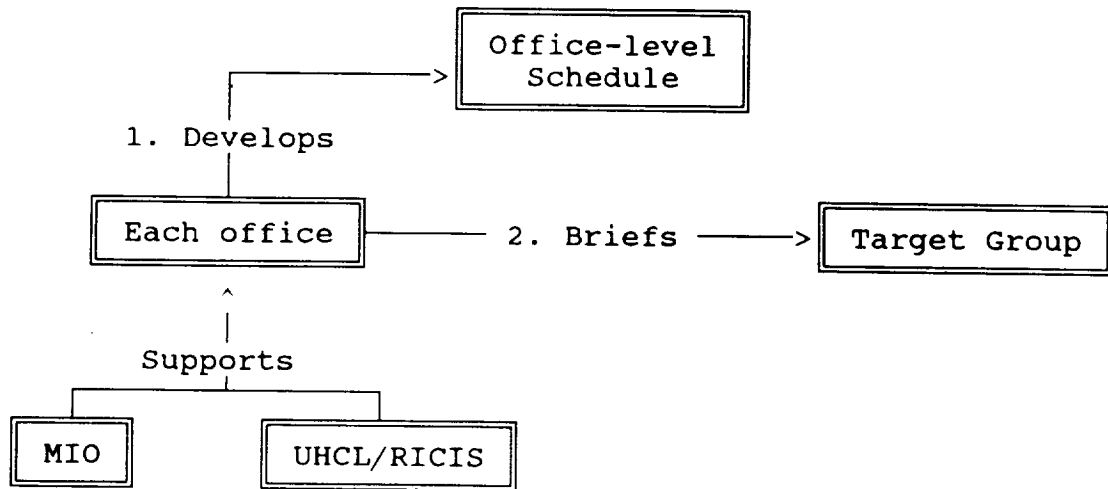


Level II -- Operate MTS

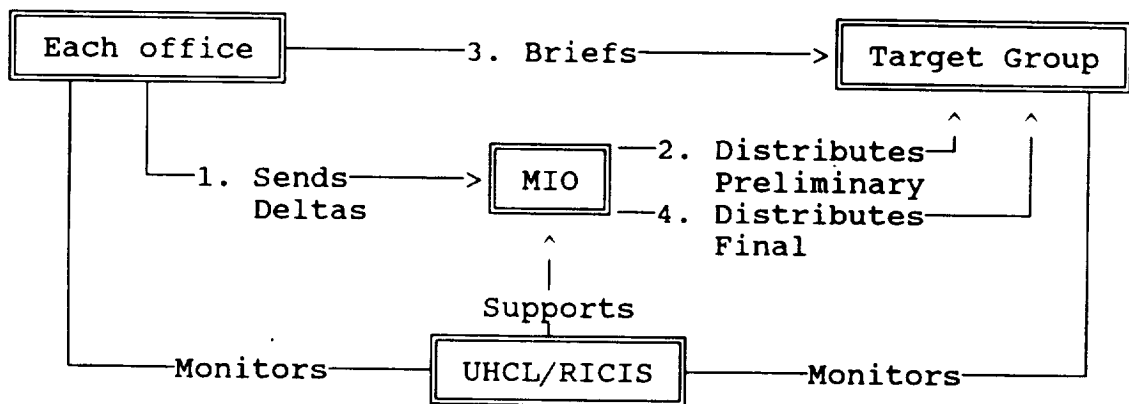


Space Station Freedom Project Office
Integrated Schedule System

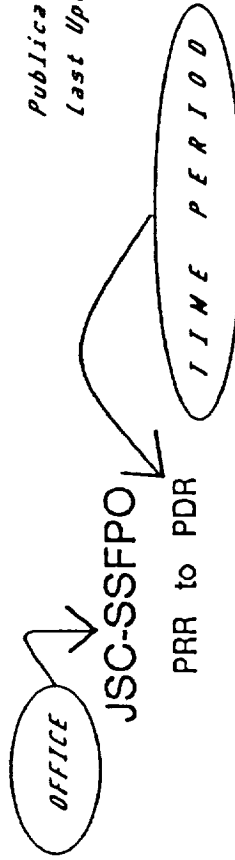
Level II-- Milestone Tracking System Initialization



Level II -- Milestone Tracking System Operation



Publication Date:
Last Update:



PRR to PDR

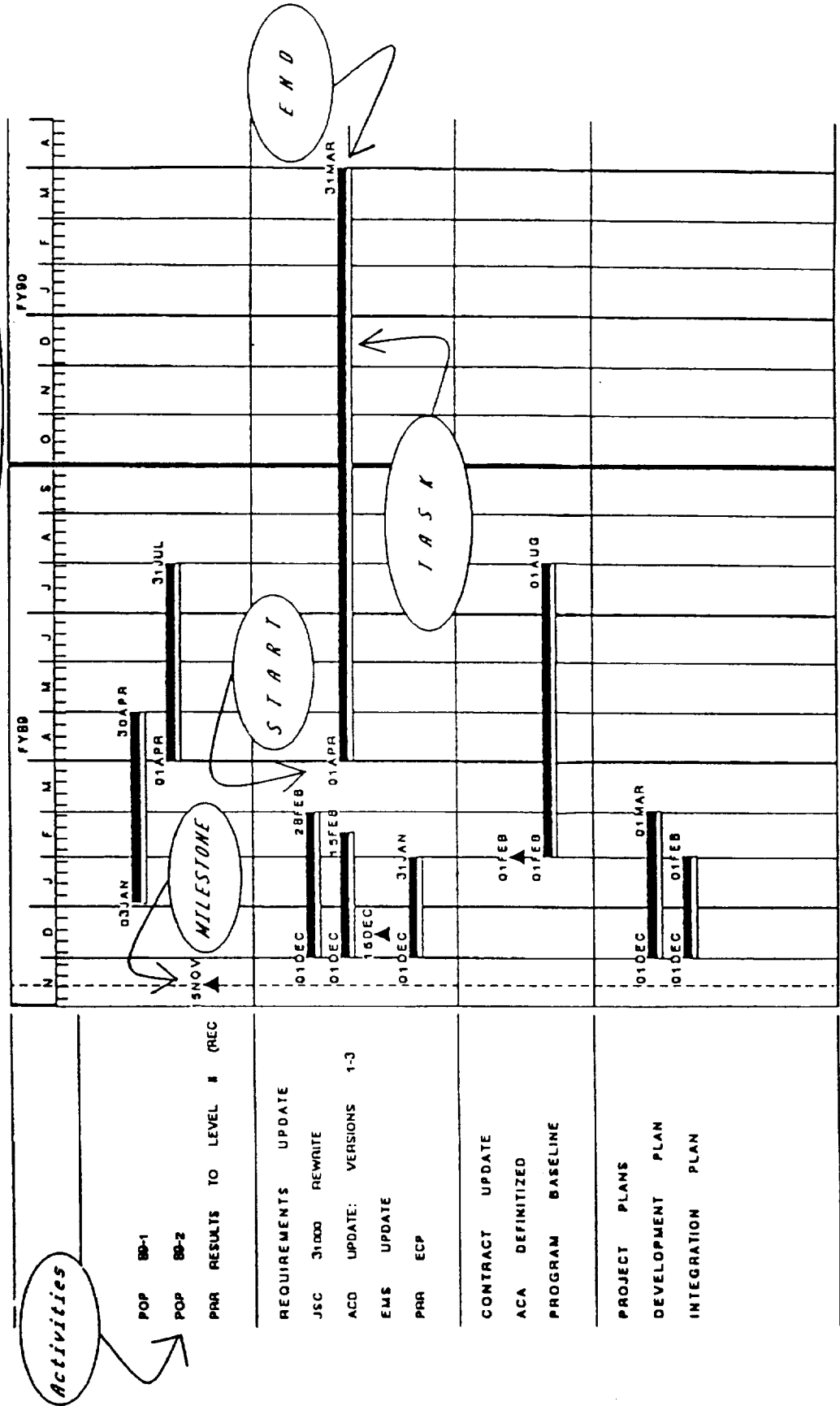


FIGURE 1